THE TRIPLE HELIX ASSOCIATION NEWSLETTER

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# Hélice

VOLUME 2 ISSUE 1 MARCH 2013

## SPECIAL ISSUE ON BRAZIL

## EDITORIAL WELCOME

*Spring Greetings!*

Towards the first days of Spring, we would like to welcome you to the First Issue of Volume Two of the Triple Helix Association Newsletter - *Hélice.* After a year of success, *Hélice.* is now in its second volume.

Distributed quarterly, *Hélice* reaches over 1500 scholars, policy-makers, and practitioners, and its outreach includes public organizations, universities, and other innovation agents.

We had received much interest and requests for the publication of Special Issues, giving a focus on Triple Helix studies in a specific national context. In response to this, we are pleased to present our first Special Issue focusing on Brazil.

The content has been coordinated by Professor Jose Manoel Carvalho de Mello, of the Universidade Federal Fluminense, Rio de Janeiro, and Vice President of the Triple Helix Association. We are grateful to Jose for his efforts in putting together this very interesting edition, which presents a brief study of the main policies for innovation in Brazil including the Triple Helix concept as a response to the need for facilitating relations between universities, public sector and companies.

Articles presented result from the long-term academic research by Brazilian scholars who have been engaged in Triple Helix Studies for more than a decade. These include (a) *The Triple Helix Concept in Brazil: Capture and Dissemination* - Jose Manoel Carvalho de Mello, (b) *ANPROTEC: Promoting Innovative Enterprises* - Jorge Luis Nicolas Audy, Sheila Oliviera Pires, (c) *Developing Brazilian Triple Helix Leadership* - Guilherme Ary Plonski, (d) *Natura: An Innovative Company Leader in the Brazilian Market of cosmetics, Fragrances and Toiletries* - Gilson Paulo Manfio, Leonardo Garnica, Daniela Diogenes, (e) *University and Patenting in Brazil* - Ana Lucia Vitale Torkomian, Marli Elizabeth Ritter doe Santos, and including Recent Publications by Thiango Renault, and Brazil: Facts and Figures by Mariza Almeido.

We also have a very thought-provoking President's Corner article on *Learning from Brazil: Inspiration of Triple Helix Innovation*, by Henry Etzkowitz, the THA President.

Finally we would like to draw your attention to the update article by Helen Lawton Smith on the forthcoming annual Triple Helix XI Conference to be held in London, 8-10 July 2013. Things are shaping up nicely for what looks like another stimulating THA Conference!

We as the Editors of *Hélice* encourage you to share your reflections which will help sustain and extend the innovative dialogue of *Hélice*.

For further information, or for publishing in *Hélice,* please contact Devrim Göktepe-Hultén at devrimgoktepe@gmail.com, or Sheila Forbes at Sheila.forbes @strath.ac.uk.

We wish you a pleasant and enjoyable spring season, and look forward to welcoming you to the Triple Helix XI Conference in London

***Devrim Goktepe-Hulten and Sheila Forbes***
**March 2013**

# *Hélice* - THA Newsletter



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Deadline for inclusion in the June 2013 issue: **13 May 2013**

# Triple Helix XI Conference, London, UK

## 8 - 10 July 2013

## Register online at: www.tha2013.org

Come and join collective action! With a spectacular line-up of keynote speakers, PLENARY sessions, 8 convened workshops, and over 50 parallel OPEN SESSIONS, the conference will have a wealth of academic and policy/practitioner presentations. Take advantage of being in London through the exciting SOCIAL PROGRAMME, including a Thames River cruise and dinner, an event in the Grand Hall of Lincoln's Inn, and a visit to Tech City (hosted at Google Campus) to meet innovating entrepreneurs.

### *The Triple Helix in a context of global change: continuing, mutating or unravelling?*

Never has the Triple Helix mission been more timely. Globally the economy faces significant challenges - unemployment, low or no growth, spiralling healthcare needs, rapidly emerging digital business models, unsustainable changes to the environment. The need for universities and businesses to work together and take action alongside governments is critical. The 2013 Conference will integrate highly topical contributions on challenges in each of the three spheres of the triple helix: universities, industry, and government, to address the key question:

### How can the Triple Helix approach build 'the enterprising state' in which universities, businesses and governments co-innovate to solve the global economic challenges?

#### Conference Themes

- How can global challenges to the digital sphere, healthcare, the natural environment and areas facing disruptive forces be turned into growth opportunities?
- How can the Triple Helix
  - create a better mode of coordination to enhance productivity, output and innovation, and what are the challenges to universities, businesses and government?
  - build innovative markets, places and networks, and what are the challenges to open innovation, demand and business models?
  - build more innovation-friendly financial institutions, and what are the challenges to the business of banking in driving innovation and entrepreneurship, especially in SMEs?
  - enhance universities as interactive partners in our innovation systems, and what are the challenges to the absorptive capacity of academic knowledge within firms and by other users?
  - enhance skills for innovation, and what are the challenges to management and leadership skills for high growth firms?
  - enhance place-based innovations, and what is the role of local innovation systems and local key institutions to build and accelerate regional clusters?
- How can public action drive innovation in the private sector, and what are the challenges to public procurement, as well as intellectual property management and IPR policies?

#### Speakers

**Will Hutton,** Principal of Hertford College, University of Oxford, and Chair of the Big Innovation Centre
**Professor Henry Etzkowitz**, President of the Triple Helix Association, Stanford University
**Professor John Goodacre,** Faculty of Health and Medicine, Lancaster University
**Sergio Arzeni,** Head, Local Economic and Employment and Development Programme, OECD
**Dr Dimitri Corpakis**, Head of Unit, Regional Dimension of Innovation, European Commission
**Dr Jon Hague**, Vice President - Open Innovation, Unilever Research and Development
**Dr Jackie Parkin**, Vice President - Research and Development, GlaxoSmithKline
**Bill Janeway,** author of 'Doing Capitalism in the Innovation Economy'.

#### Confirmed Workshops

- University entrepreneurship and entrepreneurial universities: the role of universities in the Triple Helix (organised by Circle, Lund University).
- The Triple Helix and Europe (organised by EU).
- Entrepreneurship and local development: Triple Helix influences (organised by OECD).

#### Location

The conference will be held at University of London locations, including Senate House, in historical Central London's Bloomsbury area.

#### Organisers

- Professor Birgitte Andersen, Director, Big Innovation Centre - The Work Foundation, and Lancaster University
- Tim Barnes, CEO, UCL Advances, University College London
- Professor Helen Lawton Smith, Director, Centre for Innovation Management Research, Birkbeck, University of London

#### Sponsors

* Circle, Lund University
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# PRESIDENT'S CORNER

## LEARNING FROM BRAZIL: INSPIRATION OF TRIPLE HELIX INNOVATION

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### INTRODUCTION

Organizational adaptation, experimentation, and hybridization, have been the hallmarks of innovation in Brazil as the country evolved from an authoritarian to a democratic Triple Helix.

As Ary Plonski reminds us, Brazil was in a tri-lateral mode before the Triple Helix (Plonski, 2013). Sabato's Triangle, the Argentinian physicist and science policy analyst's, top-down, government-led, model, provided a rationale for large-scale technology development projects during the military regime era from 1964-1985. This earlier theoretical substrate may have helped prepare the ground for the Triple Helix, but the two concepts are significantly at odds with each other, especially in their sources of inspiration.

Indeed, the triangle and the helice may be seen as expressions of societal regimes based on opposing authoritarian and democratic principles. A dynamic Triple Helix began to emerge in Brazil only with the breakdown of the military regime in the early 1980's, and the emergence of democracy. Brazilian Universities were a source of critical discussion groups that often took further steps to foment opposition to an authoritarian regime. They performed a role much like the scientific societies in sixteenth and seventeenth century Europe that were islands of free discussion, infusing new ideas into rigid monarchical regimes, precipitating their inevitable downfall (Heller, 1999).

A similar process of social change was telescoped into a shorter time period in Brazil. In the following we track a Triple Helix development process that shifted from single to multiple sources of inspiration, producing hybrid spaces at the intersection of the helices and a series of hybrid organizations, a regime that we have elsewhere called "meta-innovation" (Etzkowitz, Mello, and Almeida, 2005).

### THE INCUBATOR COMES TO BRAZIL WHERE IT FINDS ITS TRUE HOME!

The revolutionary political dynamic in Brazil induced a trans-formation in innovation regime, as well as governance. Creation of civil society, the sea in which multiple sources of inspiration swim, is the prerequisite for a Triple Helix of university-industry-government interactions. Civil society is a form of social organization in which people may freely associate, discuss, and work together, to organize new initiatives, openly and transparently. Brazil's transition to a civilian regime, with freely interacting institutional spheres, organizations and individuals, allowed a lateral mode of university-industry-government relations to emerge.

Instead of a hierarchical structure with other institutional spheres subordinated to government as in Sabato's Triangle, a space for interaction, brainstorming, and negotiation of joint arrangements, opened up between the institutional spheres, and their members, as they became more equal to one another with the ascension of democracy. Without a civil society base, only a static innovation model with limited initiative, typically directed by government is possible. Once democracy was achieved, Brazilian academics turned their attention to university and social reform.

The flow of individuals abroad, picking up ideas and experiences that they bring home and reinterpret to meet local needs, provided 'starter yeast' for a Brazilian Triple Helix through a process of 'innovation gain,' the inverse of brain drain. Instead of loss of highly skilled persons, typically to the developed country where they trained, innovation gain is the accession of high-level skills through returning graduates and foreign visitors and importation of novel organizational models. These flow to the developing country to fill gaps and help advance the innovation system. How incubation and the incubator migrated to Brazil from its source in the United States is a tale of organizational technology transfer. Indeed, the translation from incubator to "Incubadora" is the story of an evolving concept whose utility is only partially realized in a developed country and finds a broader expression, and fuller realization of its potential, in a developing country.

The incubator was a US invention in the 1940's Southern California aerospace industry. It began with the organization of a

"skunkworks", a place where an R&D project that did not fit the firm's remit, but management wanted to encourage, was located in an underutilized space away from the rest of the company. The semi-independent innovation support structure for new ideas, under the wing of a large firm, was expanded into an "incubator" format in which a group of unrelated projects could be undertaken simultaneously. They could even be spun off as independent firms, in the event R&D success could not be incorporated into the sponsoring firm's strategy. Several companies, including Control Data in Minneapolis, and General Electric (GE) in New York, developed this model further, and it was eventually extended from incubation into corporate venture capital, but that is another story. However, the emergence of the incubation movement in Brazil is an "innovation in innovation," or improvement in the conditions that foster innovation.

The Triple Helix model understands innovation as a broader phenomenon than product development: making 'innovation in innovation' sensible to researchers, practitioners, and policymakers, is one of its basic tenets. To better understand innovation in innovation in Brazil, we focus on the reinterpretation of the incubator concept. The incubator was transferred from industry to university, from GE to Rensselaer Polytechnic Institute (RPI), by a GE researcher, Pier Abetti, who brought it with him when he moved from the firm to the university as a Professor.

Brazilian academics, having visited the US and seen the RPI incubator in operation, or learning about it, had the idea to organize a similar project. For example, Maurcio Guedes from the Federal University of Rio de Janeiro (UFRJ) started an incubator at COPPE, the graduate engineering school. In the early 1990's it was located in a temporary building on the university campus, and Guedes often worked from a desk placed under a tree. Guedes persuaded the Rio de Janeiro Municipal Government to provide funds to build a permanent facility.

It was a controversial idea at the time for a public university to be involved in business activity. The incubator project had not received formal university approval and functioned as a temporary project. When he received the offer of funds from the municipality, the university had to approve the incubator or turn down the funding offer. The incubator facility was built at the edge of campus, with room for approximately a dozen proto-firms simultaneously, a director, and an associate director to handle internal and external management, and "incuba gula," a luncheon restaurant at the center of the building to encourage interaction among members of different firms.

Why incubation flourished and realized a broader format in Brazil is a function of the limits of R&D resources, organizational creativity, and societal needs. Academic initiatives in forming incubator facilities, recruited local governments; then industry associations became involved, followed by NGO's and national government. The original concept for the incubator was to assist the formation of high tech firms derived from research done by professors. However, the academic research base in Brazil at that time was relatively small, so the potential for academic entrepreneurship and firm formation was not large. Nevertheless, by adapting the incubator model to local conditions, the concept was expanded and put to a variety of other uses. Brazil soon had a higher rate of incubator growth than in the States, where the concept had originated.

## From Individual to Collective Entrepreneurship

Initially located on the outskirts of the university, physically as well as organizationally, the incubator gradually became more central to academia as it provided the base for development of entrepreneurial education. The incubator also took a step towards a Triple Helix innovation system by facilitating university-industry interaction. The expansion of incubation use from high-tech to a broader universe was based on the insight that the incubator, rather than solely an expression of the emerging economic and social development mission of the university, was that the incubator is fundamentally part of the educational role of the university, but with a mission to educate groups in how to organize and operate an organization. This insight led to the application of the incubator to the problem of poverty, assisting groups of favela residents to form cooperatives and create their own jobs (Almeida, Mello and Etzkowitz, 2012).

There is an incipient organizational revolution in higher education, from educating individuals to shaping organizations as well. This transition has been more difficult to discern since it typically takes place in academic contexts, such as incubators that have been viewed as part of the "third mission", rather than as part of the educational function of the university. A special graduation ceremony at the Pontifical Catholic University of Rio de Janeiro marked the departure of firms from the university's incubator facility "Project Genesis".

At the end of the ceremony each firm was given a certificate, implicitly recognizing that the university was training and graduating organizations as well as individuals. Incubation also connects back to the academic degree format by mandating a limited time period in the facility. The organizational/educational role of the incubator extends after graduation through a "club", linking groups of alumni firms with potential partners. Just as the university trains individual students and sends them out into the world, it is now doing the same for organizations.

Instead of using the concept only to form new firms, the incubator model was creatively adapted to the task of raising the level of existing firms and filling gaps in low-tech clusters. This model was called the "traditional incubator", followed by the mixed incubator, with both high tech and traditional firms, and the design incubator to assist with product prototyping. Project Genesis, directed by Jose Aranha at the Pontifical Catholic University of Rio de Janeiro, carried this efflorescence of incubation further through creation of the cultural and social incubator formats. Project Genesis exemplifies the creative role that an interface organization can play in the 'Second Academic Revolution", the university's assumption of a leading role in economic and social development.

## The Brazilian Entrepreneurial University

As academic researchers make their research relevant to addressing societal needs, they gain new sources of theoretical inspiration (Etzkowitz and Viale, 2010). An evaluation self-study of FAPESP, the science funding and science policy agency of the state

of Sao Paulo, found that this reverse linear process had begun under cover by some applicants to the Agency's basic research funding program, who were hiding their applied achievements while heralding their theoretical advances (Cozzens, Etzkowitz, and Howells, 1997). Once it was uncovered, FAPESP accepted the dual role of science in advancing understanding and economic development, and henceforth highlighted it, thereby building public support for the agency. FAPESP then took the next steps of organizing a networked genomic research project on a disease affecting the local orange crop, and inaugurated an innovation-funding program to support the development of high-tech start-ups.

The link between research and academic entrepreneurship is well known, even if sometimes controversial. But what can be said about the original teaching mission of the university and its role in Triple Helix relations? A distinctive entrepreneurial university mode has arisen in Brazil from the teaching as well as the research mission of the university, introducing an ethos of entrepreneurship to a broader population, on the grounds that it is equally relevant to the arts and social sciences as to engineering and the physical and biological sciences; to low tech as well as high tech ventures.

Entrepreneurial education, rather than being encapsulated in a single Center for Entrepreneurship, or focused narrowly on business and engineering students, is spread broadly throughout the university. At PUC Rio and he University of Brasilia, students in all disciplines are required to take a basic course in entrepreneurship. Every student learns to write a business plan just as they learn to write an essay to present ideas or a scientific research report to explain data. In an era when there is an oversupply of graduates and an undersupply of available jobs, it is essential to have this skill to write a document which sets forth clear objectives and delineates the means to realize them, place costs against those steps and, a staged plan of how to achieve those goals.

Entrepreneurial training should be part of the basic education not only of engineering and business students, but arts and performing arts students, so they may organize an art gallery or theatre group, just as computer science students may organize a software or a video game business. As a training process, a venture may be sale of snacks to fellow students, a band, or a baby-sitting service. Entrepreneurial skills should be widely available to all, not in the expectation that everyone will form an enterprise, but that graduates may become intrapreneurs and innovate within existing organizations as well.

The University of Sao Paulo established a program of student companies as part of an SME interface strategy. Each group of students is given a room with a computer and a telephone. They can be in science, engineering, or in the humanities and social sciences. In the humanities a student company translates documents. Social science students assist in the organization of conferences. The students, through their companies, become an interface between the university and its resources, and small and medium sized firms, through a service called 'dial-a technology." A company can telephone and be connected to a student company who can then deal with some of their needs. If the project becomes larger, or greater expertise is required, the firm will be put in touch with a staff person and eventually with a faculty member, if necessary.

A University-SME support program in South Korea links firms directly with faculty members, but capacity is limited due to faculty availability (Duke et.al, 2006). The Internship in SME's programme at the University of Aveiro, Portugal, utilizes students as the interface with firms, not only to introduce new knowledge to the firms, for example through logistics software packages, but also to solve the problem of status difference between Professors and often much less educated entrepreneurs. They have less difficulty interacting with students, who can act as a conduit to the university, bringing back problems that are beyond the students.

## BACK TO THE SCIENCE PARK

In Portuguese, "dora" is an all-purpose suffix denoting active agency, a state of becoming, and is widely applied to name any artifact incorporating that purpose. An intriguing art exhibition at the cultural center in a former bank headquarters in Porto Allegre, several years ago, featured dozens of objects representing the "doras", like computadora, but did not include the incubadora. Perhaps its absence was because it was not instantiated in a reasonably sized physical object suitable for an exhibit, although photographs or a video might have worked to portray an organizational concept that has become an icon.

Brazilian towns aspired to have a fountain in their town square as a symbol of municipal status in the 1930's. In recent years, the presence of a municipal incubadora has surpassed the fountain as a sign of modernity. The 'elective affinity' between Brazil and the incubator, and the question of why the incubator movement in Brazil grew more rapidly than in the US during the 1990's, was puzzling for a time. The answer provides a clue to understanding "innovation in innovation," the emergence of a Brazilian Triple Helix, and the temporary displacement of the science park by the incubator.

The devolution from a science park to an incubator model of innovation in post-military Brazil tracks the transition from Sabato's Triangle to the Triple Helix. Several science parks had been constructed in Brazil during the military regime, following the classic model of low-lying, dispersed buildings in the outskirts, familiar to the Stanford and Research Triangle examples in the US. However, in the States, these projects either arose bottom-up as at Stanford, or laterally as an initiative from state government in cooperation with North Carolina's business community. In Brazil, science parks of that era were an expression of the national government, instituted without a sufficient innovation base.

In post military regime Brazil, apart from the relative lack of high-tech firms emanating from universities to move into these parks, in contrast to the Stanford Park, or the ability of a regional government to attract government and multinational firm labs as in the North Carolina case, there was insufficient central government funding to maintain and develop these isolated physical infrastructures. Research funds for universities suffered decline, opening the way for a creative response in the form of an alternative, smaller scale, approach to academic development and innovation.

The Brazilian model of incubation is an inter-networked format of networks of local incubators that are inserted in broader regional and national networks, and ANPROTEC, the national association of incubators and science parks. The Brazilian incubator phenomenon has as a key feature a framework for incubator development that may be called "Incubador de Incubadoras," or Incubator of Incubators. A well-established incubator with experienced staff serves as the hub of a network to mentor the staff of newly established facilities, typically located in smaller universities.

The "Incubador de Incubadoras" model, systematically developing and transferring incubation expertise, is a Brazilian contribution to innovation in innovation. To move incubation ahead in an environment that does not have networking as a strong element in its culture, it may be formally introduced. Such a strategy has been adopted by Milan Polytechnic, using the incubator on the main campus as the Incubator of Incubators, to do training and benchmarking for its branch campuses. On the downside, the Brazilian networking culture is complemented by a highly bureaucratic regulatory regime that inhibits start-ups[1]. Brazilian incubators often have a legal special status, exempting incubating firms from some highly bureaucratic rules and procedures that inhibit entrepreneurship, thus providing a hidden impetus to incubation.

After decades of incubator and academic entrepreneurship development, the stage was set in Brazil for a return to the science park model. But this time science parks were organized as extensions of successful university incubators, like the one at UFRJ, or as part of an entrepreneurial university development project as in Recife, the less developed Northeastern region of Brazil. The UFRJ park was built around a joint research/test facility for deep sea drilling platforms, a collaboration with Petrobras, the national oil company. The Recife project was based on collaboration among the computer science departments of several area universities.

A staged joint development plan included a consulting firm, CESAR, that was organized to market academic computer skills to solve problems for Brazilian firms, and earn funds to support the joint academic and business development project. A task for a supermarket chain was an initial project. The best Masters students were sent abroad for their PhD's. A declining business district on an island, the city's original center, was rebranded as Porto Digital Science Park, and many of its buildings were remodeled to house software start-ups. The long-range plan was to move all of the area computer science departments to a joint campus at the science park. The Board of Directors of Porto Digital, including representatives from the areas universities, industries, and governments, served as an informal Triple Helix consensus space, brainstorming new ideas for knowledge-based development.

## The Community University working between Academy and Industry[2]

It is much debated, in both developed and developing countries, whether the third mission of the university enhances or detracts from its previous missions of teaching and research. For those who believe a focus on economic and social development is useful but believe it could detract from teaching and research, a strict separation of functions is the answer. On the other hand, advocates of integration, argue a "more the more" thesis in which academics with practical experience become better teachers, bringing real-life examples into the class room and new research ideas into their lab, inspired by industrial problems in which they discern theoretical implications.

The Brazilian community university, typically found in southern Brazil, is an intriguing compromise. For example, Feevale University in Novo Homburgo, is organized on a matrix principle. In the morning faculty spend their time in their departmental offices and labs, organized on the disciplinary Mode One model. In the afternoon, they move to offices of interdisciplinary centres, focused on the industrial, agricultural, and social problems of the region, a Mode Two applied research and development model. The division of labour between department and centre is reminiscent of the academic development of the University of California Berkeley, in which a series of state funded centres, dealing with governance issues, became an impetus to research growth on that campus, setting it on the road to distinction as a world class university.

The Innovation Law of 2004[3] allows creation of "the firm in a lab," a joint academic research group and business firm that produces research results, journal articles, and marketable products, at one and the same time in a common unit housed within the university. At the Pontifical Catholic University of Rio Grande do Sul, the 4G biotechnology hybrid, located in the University's Science Park, saves resources by eliminating the need to duplicate facilities, since the early stages of spin-off can legitimately take place within the academic lab. It also addresses the Valley of Death created by the necessity, under strict conflict of interest rules, to make too early a separation between academic research and the conduct of business. This recent development is the latest example of innovation at the interface of university-industry-government.

## Conclusion: The Brazilian Triple Helix

The Triple Helix is a metaphor, model, and inductive thesis of the social order of an emerging knowledge era. Like previous societal modalities, it is related to technological change, but the Triple Helix drives technological change as well as being driven by it. Brazil is a living laboratory of Triple Helix R&D, where the implications of imported concepts like the incubator have been

[1] Personal communication to the author (2002) from the Director of FABERJ, State of Rio de Janeiro Science Policy Agency.
[2] For an analysis of Brazilian universities, along traditional dimensions, such as the Carnegie categories and their analogues, together with a discussion of rankings, see Joao E Steiner, The Brazilian Research Universities, www.iea.usp.br/english/articles.
[3] For an analysis of the causes and effects of eh Innovation Law of 2004, see Maculan, A and Mell, J (2009), University start-ups for breaking lock-ins of the Brazilian economy, *Science and Public Policy*, 36(2), March, 109-114.

more fully realized than in their home of origin, and new hybrid innovation formats have been created like the firm-in-a-lab. Top down direction of innovation in Brazil was displaced by bottom-up initiatives, and lateral interactions as a consequence of political transition.

Whereas biological evolution relies on chance mutations; the Triple Helix relies on human intervention that has the capacity to thoughtfully shape change and direction, even if such capabilities are not always utilized. *Top down direction of innovation in Brazil was displaced by bottom-up initiatives and lateral Triple Helix interactions as a consequence of political transition.* As a framework for 'innovation in innovation,' creating new formats to enhance technological and product innovation under varying societal conditions, it has the potential to develop into a universal theory of innovation.

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# TRIPLE HELIX SPECIAL FOCUS: BRAZIL

## The Triple Helix Concept in Brazil: Capture and Dissemination

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Brazil has been at the forefront of the Triple Helix Association since the beginning, hosting one of the first Triple Helix international conferences. As the country with the largest number of delegates at almost all Triple Helix conferences - apart from the host country - the concept of the Triple Helix is well known in Brazil. In attending these conferences and, more recently, by participating in the Triple Helix Association, Brazilian representatives have played a significant role in the development of the Association

In view of the key role played by Brazil in the Triple Helix movement, the Editorial Board of *Helice* decided to publish a Special Issue on Brazil, and were kind enough to invite me to give my personnel view of the growth and dissemination of the Triple Helix concept in Brazil.

### BACKGROUND

*Rio de Janeiro, Brazil, mid-1980s.* I helped to create and head the first science and technology studies research group at the Engineering Production Program of the Graduate School of Engineering of the Federal University of Rio de Janeiro (UFRJ/ COPPE). The principal focus of the program was on laboratory studies, social construction of technology, technological systems development, and the risks of technology.

The group worked within a theoretical framework based on the work of Bruno Latour, Michel Callon (Centre de Sociologie de l'Innovation, École de Mines, Paris), and John Law (University of Keele, UK) during the 1980s on science and technological studies[1], which culminated in the formulation of the Actor-Network Theory (ANT). Under ANT, scientists and engineers act as entrepreneurs operating in an "actor-world" with heterogeneous elements, combining elementary particles with social movements and governmental bodies in the development of technological systems.

To strengthen our research capabilities we established relationships with the Centre de Sociologie de l'Innovation, and with the University of Keele, and had Bruno Latour and John Law visit us in 1991 and 1995 respectively.

We carried-out case studies in laboratories and research institutes within this actor-network perspective, analyzing the path from the development of artifacts to their commercial application and their implications for enhanced managerial strategies.

### CAPTURE

*Rio de Janeiro, Brazil, mid-1990s.* As Brazil embarked on a decade-long period of economic growth, the issue of technological innovation became supremely important to Brazil. We felt the need to enhance the conceptual base, and decided to work on the Triple Helix concept of interaction between university, industry and government developed by Henry Etzkowitz and Loet Leydesdorff.

Although the concept of the Triple Helix was only formally publicized in 1995[2], we had been following the work of Henry Etzkowitz since the publication of his research on university-industry relations and the entrepreneurial behavior of scientists and

[1]See, for example: LATOUR, B. Give me a laboratory and I will move the world", in K Knorr et M Mulkay (editors) *Science Observed*. Sage, 1983, pp141-170; LATOUR, B. *Science in Action: How to Follow Scientists and Engineers Through Society*. Milton Keynes: Open University Press. 1987; CALLON, M and LATOUR, B. Unscrewing the big Leviathan: how actors macro-structurereality and how sociologists help them to do so. In K Knorr-Cetina and A V Cicourel. *Advances in social theory and methodology: Toward an integration of micro- and macro-sociologies* (pp277-303). Boston, London and Henley: Routledge & Kegan Paul. 1981; LAW, J. On the methods of long distance control: vessels, navigation and the Portuguese rout to India. In: LAW,J. *Power action and belief: a new sociology of knowledge?* Heley: Routledge (Sociological review monograph, 32).1986.

[2]ETZKOWITZ, H and LEYDESDORFF, L. The Triple Helix: University-Industry-Government Relations A Laboratory for Knowledge Based Economic Development**,** EASST *Review* 14 (1), 1995; ETZKOWITZ, H and LEYDESDORFF, L. (Eds), *Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations*. Book of Abstracts. Amsterdam: University of Amsterdam. 169 pp.

universities in 1983[3], at the same time, coincidently, that Latour and Law were doing their laboratory studies.

By using the triple helix concept, we shifted to focus our studies on entrepreneurial universities; universities and regional development; incubators and technological parks; transfer of knowledge and technologies; patents, spin-offs and start-ups - engaging our graduate students in this endeavor.

Connections were established with the Science Policy Institute of the State University of New York, headed by Henry Etzkowitz. Accompanied by a PhD student in the group, I visited New York during the academic year 1997-1998. Henry Etzkowitz, who first came to Brazil in 1996, now comes regularly as a visiting professor, teaching courses, giving seminars and participating in discussions of Master's and Doctoral theses that are being supervised by members of the research group.

## CONNECT

As a result of our efforts and collaboration with international colleagues, our research group was thrust into a prominent position, placing Brazil in the midst of an international movement that gathered researchers and organizations around the Triple Helix approach. This *Triple Helix Movement* began with the first of a series of Triple Helix Conferences that took place in Amsterdam in 1996, organized by Loet Leydesdorff and Henry Etzkowitz. The second conference (II Triple Helix Conference) took place in New York in 1998.#

During the second conference in New York, a small but representative Brazilian delegation presented a proposal to host the third Triple Helix conference in Rio de Janeiro in 2000, under the coordination of our research group. The proposal was accepted.

In preparation for the conference, in 1999 we organized a Triple Helix Workshop in Rio de Janeiro. The event was designed to raise public awareness, and attracted the participation of twenty-five delegates from Brazil and other Latin American countries, and included Henry Etzkowitz and Loet Leydesdorff,

During 1999, junior researchers prepared a study on the changing roles and functions in institutions and organizations belonging to the three institutional spheres - university, industry and government, and the emergence of new relationships and new innovative actors in the State of Rio de Janeiro. This study was presented at the third conference.

The third conference - the so-called Rio 2000 III Triple Helix Conference, attracted more than 350 participants from twenty-five countries, and marked the entry of Brazil into the Triple Helix Movement.

## SPREAD

The Rio 2000 III Triple Helix Conference, with *"Innovation Networks and Relations University-Industry-Government: Prospects for Brazil and Latin America*" as its theme, happened at a time when policies for the country's growth focused on innovation. The theme of the event and the quality of the guest speakers and renowned international experts attracted the attention of researches, managers and policy makers. The conference received support from the Ministry of Science and Technology, the Ministry of Education, the Science and Technology Department of the State of Rio de Janeiro; and from companies and business associations. Support was also given by the National Science Foundation, USA; the Gulbenkian Foundation, and the National Organization of the Petroleum Industry (ONIP).

The concept of the Triple Helix, as well as its central thesis - the importance of university-government-industry relations for development and innovation, spread to all institutional spheres, beneffiting from the fact that public policies in innovation under discussion in Brazil had already begun to incorporate to some extent these assumptions. Since the beginning of the 2000s, new governmental policies and programs have been implemented that are consistent with the Triple Helix concept, with Brazil's Innovation Law as the cornerstone.

The Innovation Law, in effect since 2004, was designed to foster cooperation between universities and companies, and create technological innovation capable of improving Brazil's national competitive position. The main purpose of the Law was to create an environment conducive to strategic partnerships between universities, technological institutions, and companies; to encourage the involvement of scientific and technological institutions in the innovation process and the transfer of university knowledge to companies, mainly by means of the creation of Technological Innovation Nuclei at various universities, and by the release of laboratories and equipment to be shared between institutions and companies; and, lastly, to foster in-house innovation.

## MOVING FORWARD

*Niterói, Brazil, 2003*. Based on my experience with colleagues and other researchers interested in the subject, an important new focus on the teaching, research, and dissemination of the Triple Helix concept began at the Universidade Federal Fluminense, Center for Studies and Research in Innovation, Knowledge and Work (NEICT), and the Graduate Program in Production Engineering,

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NEICT[4] is a member of the INNRED network (Ibero-American Network of Innovation Support Centers) of the Program CYTED

[3]See, for example: EZTKOWITZ, H. Entrepreneurial Science in the Academy: A Case of the Transformation of Norms, *Social Problems* 36 (1): 14-29, 1989; EZTKOWITZ, H. Entrepreneurial Scientists and Entrepreneurial Universities in American Academic Science, *Minerva* 21 (2-3): 1573-1871, 1983.

[4]*GÖRANSSON, B* and BRUNDENIUS, C. *Universities in Transition: The Changing Role and Challenges for Academic Institutions. New York: Springer, 2011. 366 pgs.*

(Ibero-American Programme for Science, Technology and Development), and has been part of the Brazilian team in the Project UNIDEV "Developing Universities - The Evolving Role of Universities in Economic Growth", an international research project (2005-2009) involving teams from twelve countries, coordinated by the Research Policy Institute at Lund University.

International seminars were held at this university, with prominent researchers from Brazil and abroad attending, including Henry Etzkowitz and Marina Ranga (Stanford University), Victor Molina and Sandra Chavarría Lopez (Universidad Autónoma de Coahuila, Mexico), José Luiz Moutinho (Universidade Técnica de Lisboa and Mirror Neurons Ltda), Jorge Nunez (Universidad de La Habana), and Davide Diamantini (Università degli Studi di Milano-Bicocca)

The Triple Helix approach was included in the curriculum for the MBA in Management for Local Development, offered by the Fluminense Federal University/NEICT in Niterói, providing specialized training for Italian citizens residing in Brazil. It was an initiative of the Rosselli Foundation, Turin, in collaboration with the Università degli Studi di Milano-Bicocca, Fondazione Luigi Clerici in Milan, and the Universidade Federal Fluminense, and was supported by the Ministry of Labour and Social Security of the Italian Government.

The Triple Helix Research Group - THERG-Brazil at the Fluminense Federal University was established in 2008, with the purpose of studying relationships between the University, the Productive Sector, and the Government in Brazil. THERG-Brazil (www.triple-helix.uff.br) is housed at the Institute of Human and Social Sciences of the UFF, and has the financial support of the Carlos Chagas Filho Foundation for Research Support of the State of Rio de Janeiro (FAPERJ), and the National Council for Scientific and Technological Development (CNPq). THERG-Brazil is involved in promoting the strengthening of the network of researchers and institutions involved, through, for example, the Triple Helix blog (triplehelix.ning.com), with more than 300 members, and Ibero-American community on LinkedIn, with more than one hundred members.

In this brief account of the growth of the Triple Helix concept in Brazil, I would like conclude by highlighting some of the initiatives carried out by the joint action involving the Fluminense Federal University, through NEICT, the Pontifical Catholic University of Rio Grande do Sul, through its Office of Technology Transfer, and the THERG-Brazil.

We published a Portuguese language version of the book entitled 'The Triple Helix: University-Industry-Government Innovation in Action' by Henry Etzkowitz[5], (2009), translated with the support of Vale do Rio Doce company, the Hélice Consultoria firm, and the Federation of Industries of the State of Rio Grande do Sul.

Two important Triple Helix seminars were organized: (a) the Triple Helix Seminar in Latin America in 2009, and (b) the International Seminar on Innovation and Regional Development in 2011, focused on bringing together representatives from various countries in Ibero-Latin America.

(a) The "Triple Helix in Latin America" seminar was held in Porto Alegre, State of Rio Grande do Sul, with the main goal of discussing the interaction between university-business-government from a Latin American perspective, as an alternative means of facing the problems caused by the global crisis. Over thirty delegates from Brazil, Argentina, Chile, Venezuela, Colombia, Peru, and Mexico participated in this event, with Henry Etzkowitz and Marina Ranga, as keynote speakers. The proceedings of this seminar were published in 2010[6].

(b) The "International Seminar on Innovation and Regional Development" was held in Fortaleza, State of Ceará, organized by the State University of Ceará, addressing the issue of the contribution of innovation to regional development from the standpoint of the Triple Helix approach. Twenty-four delegates from Brazil, Mexico, Argentina, Chile, Venezuela, Colombia, Portugal, and Spain participated in this seminar, with Henry Etzkowitz as the keynote speaker.

As we look forward to the future, we do so with pride in our collective achievements and confident that in some small measure, the concept of the Triple Helix has helped to promote innovation and entrepreneurship as key factors in the economic growth of Brazil and the Region.

[5]ETZKOWITZ, H. Hélice Tríplice Universidade-Indústria-Governo. Editora EDIPUCRS, 2009. 190p

[6]MELLO, J M C and RITTER DOS SANTOS, M E (orgs.) *Seminário Hélice Tríplice na América Latina: Conhecimento para a Inovação. Porto Alegre - RS: EdiPucRS. 2010 237p.*

# ANPROTEC: Promoting Innovative Enterprises

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Anprotec - the Brazilian Association of Science Parks and Business Incubators, represents the interests of business incubators, science and technology parks, and innovation centers in Brazil. It operates through training activities and the articulation of public policies as well as the generation and dissemination of knowledge. Over twenty-five years of experience, it has 270 members representing incubators, science and technology parks, education and research institutions, government bodies and other entities, focused on entrepreneurship and innovation.

As the organization that led the Brazilian movement for science and technology parks and business incubators, Anprotec's purpose is to reinforce these institutions as instruments for the country's sustainable development, aiming at the creation and strengthening of knowledge-based companies. With this in mind, the Association supports entities that promote innovation, and trains entrepreneurs and managers of technology parks and business incubators, aiming to:

- Strengthen the leadership, representativeness and involvement of its affiliates;
- Consolidate and expand institutional relations and alliances;
- Help define and prepare public policies related to innovative entrepreneurship;
- Guide the development of the movement in harmony with major technological, economic, social and environmental trends;
- Create and improve new services, projects, and programs, for business incubators and science and technology parks.

## History

Founded twenty-five years ago, Anprotec's trajectory is directly linked to the development of business incubators and technology parks. The implementation of these environments in different regions has spread the idea of innovative entrepreneurship throughout the country, resulting in the consolidation of one of the world's largest science and technology parks and business incubation systems.

In the first decade of the movement, between 1983 and 1994, incubators expanded at the rate of little more than one per year; in the second cycle, which began in 1994 with the maturation of the Association and ended in 2007, they grew by an average of 30% per year. In the current cycle, the aim is to maintain their number at around 400, while making a concerted effort to increase their effectiveness, which has been one of Anprotec's main priorities in recent years.

Science and technology parks are gaining strength in Brazil, which now has ninety projects in various regions of the country (thirty of which fully operational). In almost fifty years of activities, the improvement in competitiveness of those locations where business incubators, business accelerators, and science and science parks and poles operate has been remarkable. These mechanisms for supporting entrepreneurship and innovation have marked the trajectory and evolution of Anprotec, and have made a substantial contribution to consolidating a strong and competitive knowledge-based industry, creating more favorable conditions for the addition of technology and innovation to Brazil's established industrial, agricultural, and service sectors. Confident in the work of the institutions it represents, Anprotec, together with the various partners involved in each of its initiatives, continues to do everything possible to ensure that innovative entrepreneurship makes a decisive contribution to Brazil's sustainable development.

## Innovative Entrepreneurship in Brazil

In Brazil as in other countries, business incubators and technology parks promote innovative entrepreneurship. The purpose of a business incubator is to help entrepreneurs to develop pioneering ideas and transform them into successful undertakings. In order to do so, they provide infrastructure and guidance on how to manage the business and improve their competitiveness, among other essential corporate development issues.

According to a 2011 study by Anprotec and the Ministry of Science, Technology and Innovation (MCTI), Brazil had 384 functioning incubators with 2,640 incubated businesses creating 16,394 jobs. They have already led to the foundation of 2,509 fully -fledged companies employing around 30,000 people and turning over US$2 billion per year. The same study revealed another important fact: 98% of incubator "graduates" innovate - 28% locally, 55% nationally, and 15% globally.

Experience shows that the incubation process results in a series of benefits for the entrepreneurs involved. By offering support, the

incubator increases the chance of success of businesses. In addition to being able to take advantage of favorable infrastructure conditions and training initiatives, the companies occupy the same space as other innovative undertakings of the same size, enabling heightened interconnectivity, favoring the growth of the business and facilitating access to the market.

In the case of technology-based companies, the entrepreneurs have access to universities and research and development institutions, with which many incubators maintain ties. This helps reduce costs and the risks associated with the innovation process by permitting access to laboratories and equipment that would otherwise require heavy investments.

Technology parks, in turn, are carefully planned science-and-technology-based productive industrial and service complexes. They are highly structured, concentrated, and cooperative by nature, comprising companies whose production is based on R&D. They help to promote a culture of innovation, competitiveness, and business ability, grounded in the transfer of knowledge and technology, in order to help the surrounding region produce more wealth.

The latest Anprotec studies indicate around thirty Brazilian technology parks in operation and more than ninety under development (some in the project phase and some undergoing implementation). In 2008, they housed around 500 companies, jointly responsible for 26,200 jobs.

The parks benefit their associated companies as well as the region and the economy as a whole, by generating an environment of cooperation between innovative companies of all sizes, from micro-businesses to multinationals, to science and technology institutions. This is because they offer high value-added services, streamlining the flow of knowledge and technology, and helping to create specialized jobs and ensure the growth of an entrepreneurial culture and activities. They also favor the formation of innovation clusters and improve the competitiveness of their surrounding regions.

Despite Brazil's notable advances in recent decades, there are still important challenges to be overcome, ranging from promoting innovation in regional systems through consolidating management of the incubators, to harmonizing public policies and financing all stages of the creation and consolidation of the emerging companies. Anprotec is convinced that these challenges will only be overcome through public and private partnerships, political will, and prioritizing innovative entrepreneurship as an instrument for sustainable development.

## ANPROTEC'S ROLE - MAIN INITIATIVES

Anprotec operates directly with the promotion of innovative entrepreneurship in Brazil by supporting science and technology parks and business incubation. To this end, it develops various educational, promotional, and knowledge-based initiatives, and creates partnerships and programs to support these mechanisms and the associated projects.

### *Generating Knowledge*

Through agreements with partnering entities, Anprotec helps generate knowledge of the best practices adopted by the Brazilian innovative entrepreneurship sector, and has published books, catalogues, studies, surveys and reference material, in order to divulge and share information on the subject.

- ***Dissemination***

  Strategic to the consolidation of the movement, the dissemination of innovative entrepreneurship is accomplished through communication channels targeting members' various stakeholders, including the media, partner institutions, and the community, among others.

- ***Training***

  In addition to the annual seminar on Science Parks and Business Incubation, Anprotec holds courses and meetings throughout the year in various regions of the country.

- ***National Award***

  Created in 1997, the annual National Award for Innovative Entrepreneurship recognizes projects, business incubators, technology parks, and graduate and incubated companies, which strengthen the movement through their initiatives, services and products. Every year, there are reports of people and institutions that make a difference in the regions where they operate, transforming the social and economic status quo.

- ***International Missions***

  In order to promote knowledge of innovation mechanisms and systems, periodically Anprotec organize international missions, allowing managers of business incubators and technology parks, as well as public administrators and other professionals who work in the area, to familiarize themselves with institutions around the world that have achieved great success in supporting entrepreneurship and innovation. Countries visited include Finland, Norway, Israel, the United States, Germany, and Estonia.

- ***Anprotec Seminar on Science Parks and Business Incubation***

  Each year Anprotec, in association with the Sebrae (Brazilian Micro and Small Business Support Service), holds the Anprotec Seminar on Science Parks and Business Incubation, one of the largest events of its type in the world. By uniting institutions with a common interest, the seminar is an important tool for consolidating innovative entrepreneurship in Brazil, and helping to strengthen business incubators and technology parks, as well as public policies related to science, technology and innovation. The discussion of issues that are fundamental to economic and social development, the fruitful exchange of experience among the participants, and the resulting proposals are attracting increased numbers of participants from Brazil and abroad.

  The five-day Seminar is held every year in a different region of Brazil and includes plenary sessions, lectures, minicourses,

parallel meetings, strategic meetings between movement agents and technical visits. Since 1993, the event has included the Anprotec Workshop, a forum dedicated specifically to Anprotec associates, aimed at ensuring a detailed discussion of issues considered strategic for the development of business incubators and technology parks in Brazil.

- ***Cerne***

Established in 2006 by Anprotec, the Cerne (New Project Support Center) is a new business incubator operational model, which aims to constitute a platform of solutions to increase the capacity to systematically generate successful innovative projects. This creates a reference base, whose elements can be used by business incubators in different areas and different sizes to reduce inconsistencies in achieving business success.

- ***Strategic Partnerships***

Anprotec is convinced that the success of the incubators, parks, and innovating companies, depends entirely on the successful establishment, cultivation, and improvement of institutional partnerships. Accordingly, the Association has a substantial group of partners, who realize common objectives in the form of programs, projects, and cooperative initiatives, whose results always generate tangible benefits for the entrepreneurs and their nascent companies.

Its main partners include the Brazilian Micro and Small Business Support Service (Sebrae), the Ministry of Science, Technology and Innovation (MCTI), the Ministry of Development, Industry and Trade (MDIC), the National Confederation of Industry (CN), the Brazilian Association of Technological Research Institutions (ABIPTI), the National Association of Research, Development and Engineering of Innovative Companies (Anpei), the International Association of Science Parks and Areas Of Innovation (IASP), infoDev and the European Business and Innovation Centre Network (EBN).

# DEVELOPING BRAZILIAN TRIPLE HELIX LEADERSHIP

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## 1. BACKGROUND

The *Triple Helix of University-Industry-Government Relations* (in short, *Triple Helix*), a concept that emerged in the mid-1990s, found fertile ground in Brazil. The reasons were threefold: intellectual, institutional, and practical.

From the intellectual perspective, two earlier pragmatic models akin to the *Triple Helix* (TH) had already established roots in the Brazilian academy and, through advanced education programs and professional mobility, reached public policy makers and company R&D managers.

The first, which became known as *Sábato's Triangle*, was proposed in the late 1960's by two Argentinean researchers: Jorge A Sábato, a unique combination of teacher, researcher, entrepreneur, journalist, and manager of the national nuclear program; and Natalio R Botana, a political scientist. They envisioned a dynamic triangle of interactions between the scientific infrastructure, the productive structure, and public policies as the sole way to lodge science and technology (S&T) into the mainstream of the developmental process, enabling Latin America to overcome its historic underdevelopment condition.

The other intellectual basis was the known *National System of Innovation* theory, proposed in the late 1980's by the British Professor Chris Freeman, based in part upon his work with the Professor Bengt-Åke Lundvall from Denmark. Contrary to the traditional linear innovation model, they affirmed that technology progress and innovation are results of a complex set of relationships among actors in the system, including enterprises, universities, and government.

Two initiatives reinforced the institutional base for TH in Brazil. The first was the issuing, by the then military authoritarian regime, of three editions of the national *Basic Plan for S&T Development*, in tandem with the respective National Development Plans, during the 1970's and first part of the 1980's. The other builder of the institutional base for TH was international cooperation, mainly from multilateral organizations, among them the World Bank, the

Inter-American Development Bank, the Organization of American States and the Ibero-American Program of S&T for Development (acronym in Spanish: CYTED). With different nuances, numerous programs financed by these agencies during the 1970's-1990's were aimed at giving dynamism to the flow of knowledge between academia and industry, by means of smart public policies and initiatives.

In addition to these intellectual and institutional elements, representative cases of TH practice became visible. One major example was the *Deep Water Technology Capability Program* (acronym in Portuguese: PROCAP), established in 1986 by the national oil company Petrobras, in order to explore and extract oil from below 400 meters of sea. As technologies for this complex challenge were unavailable at the time, the company devised a network of academic research groups, in areas ranging from Geophysics to Future Studies, coordinated by its R&D Center. This successful cooperation, which helped Petrobras to become and maintain the position of world leader in technologies for deep and ultra deep water oil exploitation, evolved into one of today's largest and most sophisticated practices of the TH concept in the world.

## 2. Leadership Matrix and Processes

As in several other areas, the main wellspring of leaders for science, technology, and innovation (ST&I) thinking, policy, practice, and management in Brazil has been the university. It is therefore natural that academia would be the hotbed for TH leaders *avant la lettre*.

Four key development processes were put in place since the timeframe of the intellectual, institutional, and practical evolutions highlighted in item 1: executive education, graduate studies, innovation habitats, and intermedial entities. Other key processes, such as professional mobility and coordinating organizations, have been associated with each one of the four described here.

### *2.1 Executive Education*

The main program for advanced education relevant to TH-oriented leadership, established in the early 1970's by the National Innovation Agency (acronym in Portuguese: FINEP), was operated, for almost three decades, by the Center for Technology Policy and Management[1] (acronym in Portuguese: PGT), at University of São Paulo (USP). The original name, *Training Program for Management of S&T Research* (acronym in Portuguese: PROTAP), hints both at the perception of the need to professionally manage research in order to enhance its effectiveness, and at the linear innovation model then prevalent.

Several spin-offs arose from the Program, mainly: (i) the *Training Program for Managers of industry-University and Research Institute Cooperation* (acronym in Portuguese: PROTEU[2]), also offered in partnership with CYTED, in other Latin American countries; (ii) the *Training Program in Management of Innovation Processes in Organizations, with international emphasis* (acronym in Portuguese: PROTAPi), under contract of the Ministry of ST&I, in partnership with the Federal University of Bahia; (iii) open MBA courses, presented by the Institute of Management Foundation, a private not-for-profit organization created by USP Business School Management Department faculty; and (iv) the Advanced course in Management of Innovation Habitats, a pioneering initiative of the Brazilian Association of Science Parks and Business Incubators (acronym in Portuguese: ANPROTEC), which was recognized by the International Association of Science Parks, and supported by several governmental and quasi-governmental agencies.

The scheme shown (page 14) highlights the evolution of the executive educational activities carried out by USP, which are related to the advancement of TH in Brazil.

Approximately 1,600 professionals participated in the executive education programs. Some of them became key actors in the Brazilian TH scenario, occupying positions such as Deputy Minister of ST&I, CEO of the National Innovation Agency, and Chief Scientist of the main Brazilian aircraft manufacturer (#4 in the global ranking).

Some of the coordinators and faculty involved in the executive education initiatives achieved advanced positions, such as Rector of USP[3], the highest internationally ranked Latin America university, and CEO of the São Paulo State Research Institute (acronym in Portuguese: IPT), the most important Brazilian industrial research institute.

### *2.2 Graduate Studies*

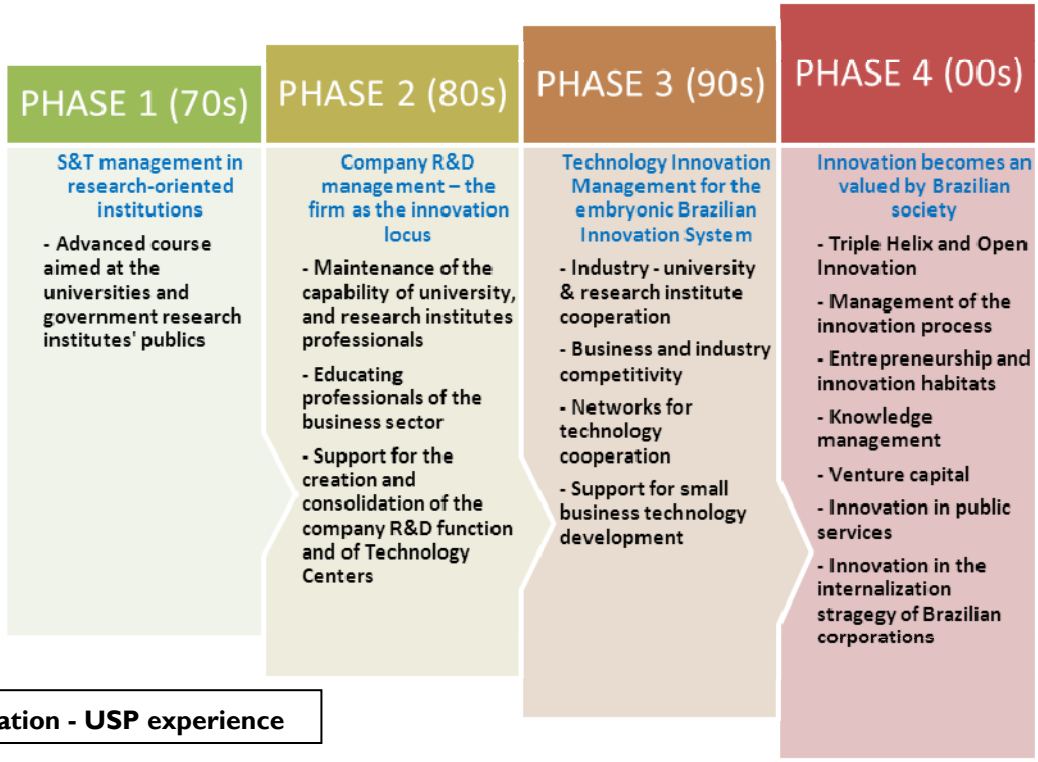
The first Brazilian graduate students interested in S&T Policy and Management got their degrees during the 1970's and 1980's in the USA or in the UK - in this case, mainly at the University of Sussex based Science Policy Research Group, led by Professor Freeman.

Upon their return, they created centers for S&T Policy and Management Studies, with diverse nuances, in some of the leading Brazilian universities, which have operated continuously for more than three decades: Federal University of Rio Grande do Sul, Federal University of Bahia, Federal University of Rio de Janeiro, Pontifical Catholic University of Rio de Janeiro, State University of Campinas, and USP.

These centers received a boost, during their early stage, from the S&T Development Support Program, established with funds from a World Bank loan taken by the Brazilian Government.

The students graduated from these pioneering centers, established centers, or other forms of organized research groups in several other Brazilian universities.

[1] This is the current name.
[2] The acronym is inspired by the name of an early sea-god from Greek mythology. Proteu (or Proteus) can foretell the future, but will change his shape to avoid having to do so, answering only to someone who is capable of capturing him.
[3] In the Brazilian Academy, the Rector is the highest university authority.




**Executive Education - USP experience**

The aggregate production of master, doctoral, and post-doctoral works, by scores of graduate students generated a wealth of knowledge about virtually every aspect of TH and ST&I related subjects in Brazil. Some of the graduates became important actors in the national TH scenario as, for example, Deputy Minister of Development, Industry, and Foreign Trade. Some of the faculty members of these centers also achieved relevant positions, such as Vice-President of the Brazilian Development Bank.

A spin-off of the USP group was the creation of the National Association of Innovative Companies Research and Development (acronym in Portuguese: ANPEI) in 1984, inspired by the US Industrial Research Institute model. This Association has been very active in pursuing a TH agenda for Brazil.

### *2.3 Innovation Habitats*

In 1984, the National S&T Development Council (acronym in Portuguese: CNPq) established a Brazilian Technology Park[4] Program, in order to boost university-industry cooperation. For several reasons, only two of the six intended Parks took off. On the other hand, this pioneering initiative inspired two spin-offs that are relevant to TH.

The first was a series of technology-intensive business incubators, a model more suited to the objective conditions of the ST&I area in Brazil at that point in time. From a yearly average of 1.3 during the first ten years, the number of incubators grew exponentially after 1994, the year when inflation was finally reduced from levels as high as 85% per month to less than 6% per year.

The second spin-off was the coalescence of a small group of young university graduates who believed in innovation habitats as a keystone to transforming the Brazilian industry and leading the country to becoming a knowledge-based economy. In 1987, they created ANPROTEC, a thriving association, described at length in another section of the present issue of *Hélice*.

As a result of the introduction of innovation in the Brazilian agenda, mobilized by the landmark II National Conference of ST&I in 2001, several Technology Parks initiatives were established. The current number of innovation habitats is 384 business incubators, and circa 25 operating Technology Parks (with several others in different stages of planning and implementation).

Most of these innovation habitats were established by universities. This has had an enormous impact on the academic ethos, as attractive companies - both dynamic start-ups and R&D centers from emblematic corporations - are now within or nearby campuses. This has generated a bilateral flow of students and researchers. Entrepreneurship became a desirable characteristic of students, at least in some university schools. The decade-long debate about cooperating or not with industry became superseded by the facts in the field.

The presence of business incubators enabled the completion of the so-called *Knowledge Triangle*: students who learned how knowledge is transmitted (in the classroom) and produced (in the laboratory), are now also exposed to the intricacies of transforming knowledge in innovations (in the incubator).

[4] The names Science Park, Technology Park, Research Part, or S&T Park are used interchangeably.

Supporting innovation habitats is an important public policy of the Federal, State, and some Municipal administrations. There is a National Program of Support of Technology Parks and Business Incubators, led by the Ministry of ST&I, which serves as a platform to articulate actions of several institutions.

The Brazilian innovation habitats movement became a classic case of TH in action. In addition, several managers of technology parks and business incubators became important actors in the TH scenery, occupying positions such as Minister of ST&I, State Secretary of S&T, Municipal Secretary of S&T, and University Rector or Vice-Rector.

### *2.4 Intermedial Entities*

The TH context in Brazil has been gradually enriched by complementary entities - financial (angels, venture capital, soft loans providers … ), NGOs (industry associations, professional societies …), media (professional journals, mass media … ), specialized professional services (legal, accounting, marketing, consulting … ), and others.

In addition, intermedial entities have played a relevant role in increasing the interactions inside the TH. One very important category comprises circa seventy public or not for profit private research institutes, the former pertaining either to the Federal or to State Government. Usually specialized (e.g. agriculture, biotechnology, energy, health, industry, information technology), they are vital for transposing the, frequently, wide abyss between institutions that produce technical knowledge and the ones that need it. This is due to the fact that they are positioned in what can be called an *optimal cognitive distance*[5] between universities and business.

There has also been a flow of professionals from research institutes to key positions in the Brazilian TH - to universities (e.g. as Vice-Rector), to industry (e.g. as Vice-President for R&D), and government (e.g. as Congressperson, leading the S&T interest group).

## 3. CONCLUSION

Brazil easily accepted the evolution from university-industry cooperation to a TH model, because the role of Government has been recognized since the 1970's, as a result of the intellectual presence of what became known as the *Latin American School of S&T Policy*, epitomized by *Sábato's Triangle*. A deeper understanding of the socio-political dimensions of innovation was achieved in the 1990's, through the diffusion of the holistic concept of National Innovation System.

The TH concept, which became widely known in Brazil in the 2000's after the Third TH Conference, titled *The Endless Transition*, and held in Rio de Janeiro, helped to advance the dynamics of cooperation among the different actors. One concrete expression was the enactment of the Federal Innovation Law, in December 2004, followed by a similar law in most of the twenty-seven Brazilian states and Federal Districts.

In spite of the obvious advances during the last decades, there is still widespread dissatisfaction among the Brazilian TH actors with the status of innovation in the country, with each actor blaming the others.

This paper, written by an academic who worked in business and held a Government appointment, states that, contrary to the usual discourse of isolationism and self-centeredness, the university has been a main agent for the promotion of TH, far beyond its generally assigned role of original Science knowledge-producer. Four of the means developed for this purpose were briefly described: executive education, graduate studies, innovation habitats, and strong connections to intermedial entities.

[5] The *optimal cognitive distance theory*, developed by the Dutch emeritus Professor Bart Nooteboom in the frame of collaboration among firms, proposes that a trade-off exists between the novelty value of the knowledge firms seek to acquire and the difficulty of acquiring it, so that the optimal cognitive distance between the interacting firms should be of a medium level.

# Natura: An Innovative Company Leader in the Brazilian Market of Cosmetics, Frangrances and Toiletries

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## Innovation in a Competitive Market

Natura is a leading cosmetics, fragrance, and toiletries company that sells through a network of 1.4 million consultants (sales representatives) in Brazil and abroad. Outside of its core Brazilian market, Natura has a presence in Argentina, Bolivia, Chile, Colombia, France, Mexico and Peru. Established in 1969 from the fruit of two passions: cosmetics and relationships, for over forty-four years it has sought to create value for society as a whole, generating integrated triple-bottom-line (TBL) results - economic, social and environmental.

Natura´s TBL strategy and efforts are successfully recognized by international institutions. As an example, in 2011 and 2012, it was the second most sustainable company in the ranking of 100 Most Sustainable Corporations in the World by the Canadian Corporate Knights Research Institute. It was also placed as the eighth most innovative company in the world by Forbes Magazine in 2011.

In the international arena, Brazil ranked third in 2011 as one of the largest markets for cosmetics, after the United States and Japan, with an 18.9% growth (ABIHPEC, 2012). This attracted the world´s attention to the Brazilian market, and anticipated a surge for differentiation amongst companies that intended to remain competitive in this market.

In view of this highly competitive context, Natura redefined its corporate strategy emphasizing innovation as one of its core capabilities and main drivers of development. Today, innovation is strongly encouraged thanks to the incorporation as one of Natura´s culture drivers - "*Innovation - be entrepreneurial, taking the lead, doing what has never been done and assuming the risks. Continuously scrutinize the way things are done and striving to find new ways to do them"* (Natura, 2012). Innovation is understood as a process that should permeate all activities and is at the core of the company´s value creation. It is expressed in Natura's products, commercial model, management system, and the relations it establishes with its stakeholders and society as a whole.

## Innovating Innovation

To promote this corporate culture, a range of initiatives have been put in place over recent years with the objective of refocusing and leveraging innovation throughout the company. A turning point towards reshaping innovation at Natura was the movement named "Innovating Innovation", in 2011. It derived from an analysis of the company´s position in the global cosmetics industry, its differentiating factors, innovation processes, and governance, conducted in partnership with an international consultancy group. The results spurred the introduction of a range of initiatives, mainly impacting the Innovation Vice-Presidency, such as:

- a revised long-term innovation strategy;
- structural changes in the R&D areas;
- the evolution of the product innovation process;
- a revised portfolio management process and governance;
- a broader and significantly revamped open innovation strategy, integrating different actors from the Brazilian innovation system, and a growing number of international partnerships in the USA, UK and France.

One of these transforming changes was the redefinition of Natura´s "innovation differentiators". These can be understood as strategic guidelines that include and define new competencies as well as the classical ones, necessary for carrying out innovative research and product development at Natura, using an integrated approach. Traditional methods and *state-of-the-art* science and

technology are integrated in order to help create new products and services that provide an ongoing flow of Well-Being-Well Experiences for consumers, while promoting positive socio-environmental impacts and reducing negative impacts. In alignment with strategic planning, the innovation differentiators guide the creative process and underpin research in science, technology, and open innovation. Natura´s differentiators include five fields of play, comprising: Life Sciences; Sustainability; Well-Being-Well Experiences; Wellness, Senses and Design of Interactions; and, Relationships and Networks. These support the company´s vision for long-term innovation, and the work of its five innovation teams: Science and Technology, Product Development, Consumer Safety, Portfolio Management and Innovation Networks, and the Innovation Core. The latter was recently established with the objective of accelerating the creation of novel concepts, brands, and business opportunities for Natura.

The product development process was revised in 2011, focusing process maturity of the classical product development stage-gate, with updated requisites, process specifications, and employee training, amongst others. This was coupled with the adoption of a new infrastructure for managing project information, using a Sharepoint internet-based platform, with information for project management that accompanied Natura's stage-gate process.

In addition to these evolutions, Natura´s innovation team implemented a new portfolio management process, which focused on the analysis of the intangible value of new products, as well as direct estimates of individual product financial contribution (Hashiba-Horta *et al*., 2012). To realize the importance of a robust new product development (NPD) pipeline for the company´s survival, one needed to understand the high demand for new products that the Natura´s direct sales model requires. Natura publishes a new product catalogue every three weeks (one cycle), and consultants rely on these to engage with consumers and generate sales opportunities. In our current sales model, there are eighteen cycles per year, with an average of fifteen new products per cycle, and, thus, a strong demand for a high throughput of new product launches.

Following pressure from competitors, Natura´s NPD portfolio started to become overloaded, with a very significant resource allocation to a large number of low impact projects. This realization triggered a revision of the drivers for developing new products in order to better select the products that would help maintain competitive advantage. The solution came in the integration of a portfolio management strategy that combined tangible (financial, estimates of the first-year gross revenue generated by the project), and intangible values (strategic). The latter comprised a combination of three important aspects of Natura´s strategy: Environmental value - the higher the carbon emission reduction, the higher the score; Consumer perception - measuring the potential impact of the new product from a consumer perspective; and Brand Differentiation - providing an overall evaluation of the project based on the additional brand value that the new product could bring. The initial analysis indicated that the top 10% of projects represented 50% of the overall portfolio value, an analogy with Anderson´s long tail (Anderson, 2004). This triggered a strong action to eliminate low-value projects that lead to the elimination of unproductive SKUs, and increased overall productivity (value/project) by 20%; yielding a better allocation of human resources, and an improvement of the financial tools at the start of the project in the pipeline.

### Revamping Open Innovation

In the open innovation front, Natura has established a comprehensive model for fostering collaborative networks for innovation. This design has four main pillars, as described below (Varrichio *et al*., 2012; Garnica *et al*, 2012):

a) *Policies and process*: focus on the internal organization to support the open innovation strategy considering the diversity of partners and types of agreements. This pillar exists for compliance with legal procurement procedures, and to generate corporate procedures that maintain consistency in the relationship with external partners. It includes the design and monitoring of key success indicators, as well as guidelines for partnerships and intellectual property (IP) protection. The mainstream process begins with the selection of partners passing through negotiation, formalizing partnerships, and ends with the evaluation of partners.
b) *External funding*: one objective is to bring the government close to the company´s innovation process. The main activities are devoted to monitoring new funding opportunities aligned to internal demands, grants management structure, evaluation and the use of tax incentives in Brazil and in France. As a result of funding management, we received more than US$11 million in tax incentives for innovation in the form of grants and funds from different partner institutions (public funding agencies in Brazil) such as FINEP, BNDES, CNPq and FAP in 2011.
c) *Promotion of open innovation networks in a highly collaborative fashion*: Natura believes strongly that research institutions are recognized sources of knowledge and technology for companies. The significance of these concepts reside in the perception that long-term relationships are able to add value in more phases of the innovation cycle, and are more valuable than specific interventions or ideas captured in the early innovation stage. As a result of this, a new program was constructed aiming at establishing an active relationship with research institutions, promoting network connections, engaging Natura´s internal R&D staff in the diffusion of the company´s scientific research results, enhancing its research topics, and building a learning space that encourages collaboration, and multiple forms of interaction (calls for proposals, innovation challenges, scientific blogs, and interactive workshops).
d) *Relationship management focused on innovation partners:* this pillar involved the management of a relationship agenda for different innovation partners, such as funding agencies, universities, and corporate partners, aiming to align expectations and maintain a constant flow of communication that would lead to the identification of new opportunities. This approaches the adoption of specific activities that promote the sharing of innovation strategies, and stimulates new-comers into the network, to join forces in the pursuit of initiatives that provide benefits for all involved.

In parallel, investments in innovation also increased - from R$103.0 million in 2008, to R$146.6 million in 2011, representing approximately 3% of net revenue invested in innovation and 164

new products in 2011, with an innovation rate of 64,8% (percentage of revenue coming from new products launched in the two previous years). In order to maximize and focus on investments, substantial changes were incorporated in the R&D funding process, including the definition of a strategy to integrate public funding opportunities offered by the Brazilian Government, and analyses of R&D activities profiles performed by the company in order to clearly identify financing and incentive opportunities directly related to these (Jorge and Hashiba, 2009). Results helped define a strategy for R&D funding that balanced financing sources covering basic activities, such as headcount costs, services, training and equipment, in contrast with high-risk projects, that focused on the acquisition of know-how and technology trends. The former were preferentially served by funds arising from subsidized loans (low taxes), tax incentives for R&D from the Brazilian Government, and internal capital, and the latter by non-refundable governmental programs, such as research grants and special funding for enterprise -university cooperation projects. These actions promoted a four point increase in the percentage of external capital on total R&D investment, from 38% in 2006, to 42% in 2008, and almost doubled the amount returned from income tax and social contribution deductions derived from R&D activities.

As concluding remarks, our understanding of the evolution of Natura´s innovation approach in recent years corroborates the value of adopting a systemic view that considers innovation as a complex process permeating all of the company, strongly influenced by internal processes and corporate culture. In our experience, integrating different approaches in an orchestrated way in order to promote innovation at Natura is perceived as a key element for success.

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## University and Patenting in Brazil


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### Introduction

Recent studies show that the role of universities and research institutes in regional innovation and development has required new forms to transfer knowledge produced by academic research (OCDE, 2003).

According to Etzkowitz (2009, p193), "we have gone from an era that was founded on the concept that research automatically translates into usage to an era in which the policies are continuously reinvented to reach that objective".

In this context, measures have been taken by the Brazilian Federal Government towards encouraging the transformation of generated knowledge into wealth by means of effective actors, as recommended by the Triple Helix Model proposed by Etzkowitz and Leydesdorff (1996).

The Innovation Law (BRASIL, 2004), is a major landmark in this process. It offers incentives to innovation and scientific and technological research in the production environment, covering several support and motivation mechanisms for the constitution of national alliances, including the creation of facilities for public

universities and research institutes to be able to share their laboratories, premises, infrastructure and human resources, with companies (including micro and small ones) and non-profit private organizations for incubation or research activities.

The Law also brings out the possibility of universities and research institutes signing contracts of technology transfer and the licensing of patents they own, and providing specialized consultancy services for companies.

The support for financial, material or infrastructure resources to serve Brazilian companies involved in research and development activities is included in the Law. Support to carry out research and development activities that involve technological risk to solve a specific technical issue or obtain an innovative product or process is included, as well as the implementation by development agencies of programs with actions aimed especially at promoting innovation in micro and small companies. As established by the Innovation Law (BRASIL, 2004), universities and research institutes are required to have a Technology Transfer Office (TTO), called Technological Innovation Nucleus (NIT) available to manage their innovation policy. The minimum competences of a TTO are:

- oversee the maintenance of the institutional policy for stimulating the protection of intellectual policy (IP), licensing innovation, and other forms of technology transfer;
- assess and classify the results from research activities and projects to meet what is established by the Law;
- assess requests from independent inventors to adopt an invention;
- allow for the convenience and promote the protection of IP developed at the institution that are liable to intellectual protection; and
- follow up on the processing of requests and maintain the institution's intellectual property titles.

## University and Patenting

As a consequence of this new role assigned to universities, issues of intellectual property and technology transfer began to occupy the agendas of policy makers in universities, especially in public universities. Since then an increasing number of universities and research institutes began to integrate the national Intellectual Property (IP) system by means of patenting and technology transfer activities, spreading the culture of innovation, increasing the awareness of the importance of protecting research results and bringing forth the need to introduce institutional policies for intellectual property. One of the results of those measures was the sharing of economic benefits with academic researchers. As an outcome of these actions, a greater number of universities joined the system: from 2000 to 2004, 47 academic institutions were identified as applicants for 784 patents. In 2005 alone, after the Innovation Law, 323 applications were filed by universities, showing significant growth in the number of institutions participating in the IP system (Ritter dos Santos and Mello, 2009). Figure 1 shows the evolution of university patenting from 2007 to 2011, indicating a growth of about 450% compared to 2005.

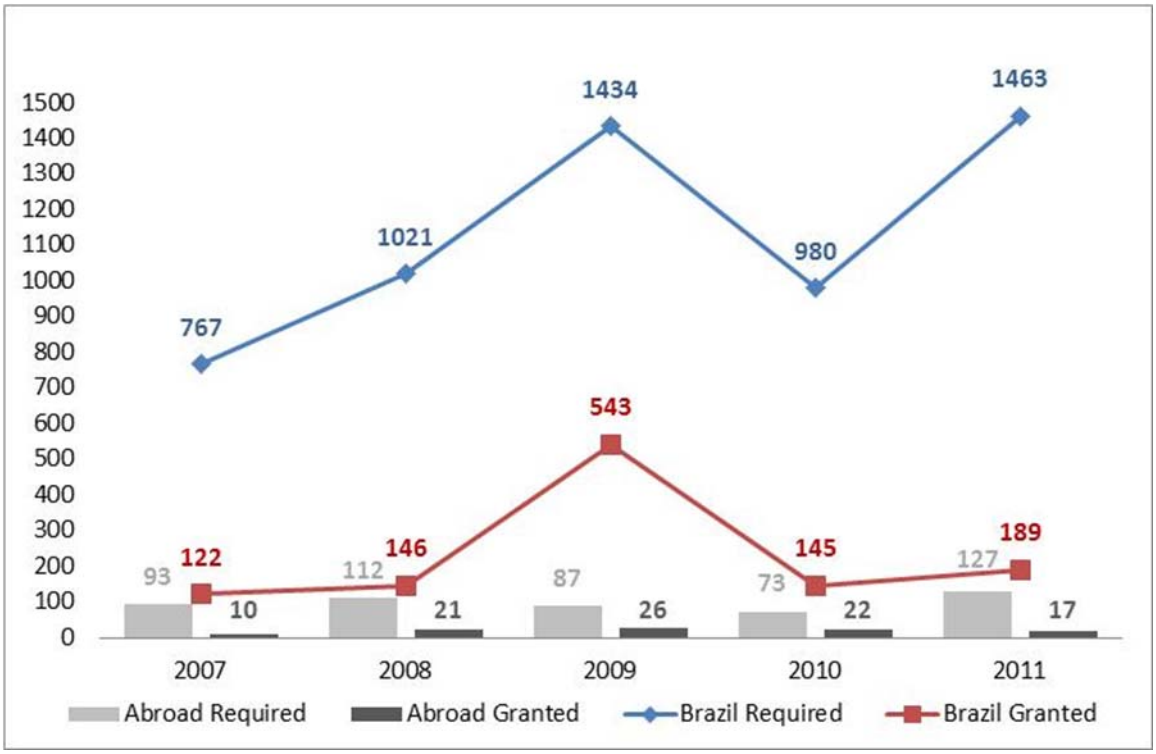


**Figure 1: Required and Granted Protections to the Universities and Research Institutes (MCTI, 2012)**

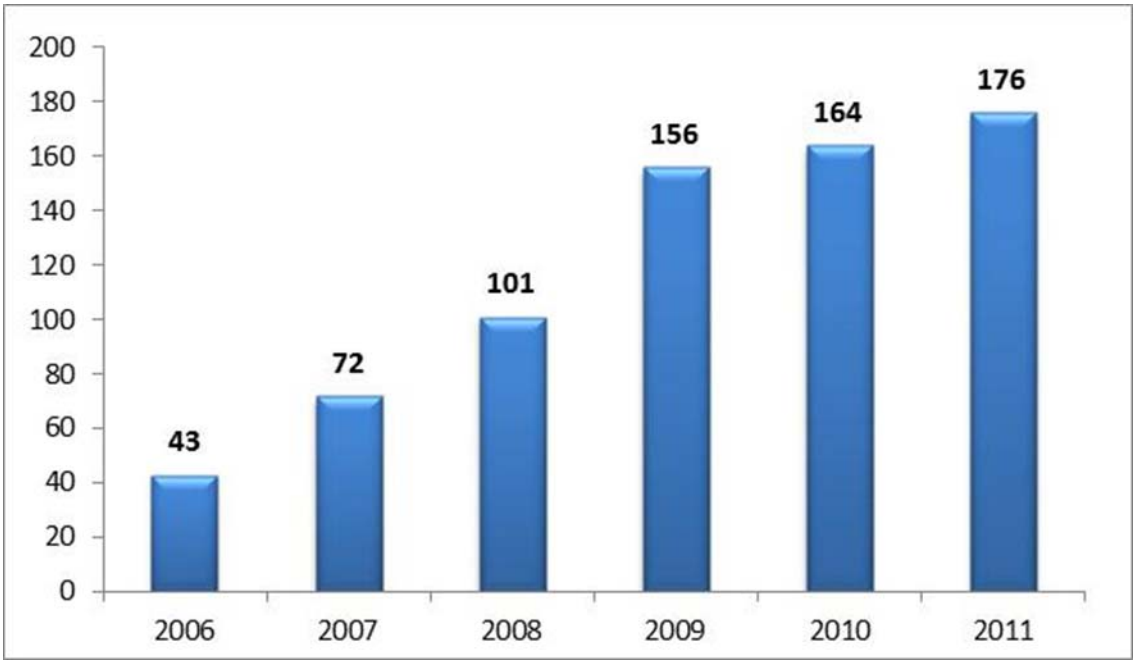


**Figure 2: TTOs in operation in Brazil (2006-2011) (MCTI, 2012)**

In 2011, the 144 countries that are part of the Patent Cooperation Treaty (PCT) requested the registration of 181,900 patents, an increase of 10.7% compared to the 164,316 patent applications in 2010. The volume of requests was a worldwide record in 2011, and annual growth was the strongest since 2005, in spite of the unfavorable worldwide economic conditions according to the WIPO - World International Property Organization (WIPO, 2011).

In the same year, Brazil recorded a 17.2% increase in the volume of patents filed through the PCT with 572 requests compared to 488 in 2010, according to provisional data disclosed on March 5 by the WIPO. The result represents a significant improvement in the IP area performance, given that between 2009 and 2010, Brazil had recorded a drop of 0.8%. From 2007 to 2011, the country filed 43% more patents through the PCT, whereas worldwide growth was only 13.7% (WIPO, 2011).

However, it must be pointed out that even though the volume of Brazilian patents increased significantly, the participation of companies is still modest, with the main volume of patents having originated from universities and research institutes.

According to information provided yearly by the universities and research institutes to the Ministry of Science, Technology and Innovation, the number of TTOs in operation has increased significantly from 43 in 2006, to 176 in 2011 (Figure 2).

The enactment of the Technological Innovation Law influenced the creation of FORTEC - Brazilian Forum of Innovation and Technology Transfer Managers. Within such a favorable national background, FORTEC became a similar institution to the international organizations such as *AUTM* (United States), *Réseau Curie* (France), *Praxis-Unico* (United Kingdom), *Red de OTRIs* (Spain) and *RedViTec* (Argentina), among others. Inspired by these international experiences, the creation of FORTEC on 1 May 2006, provided significant support to managers in carrying out their activities, as well as widening their representation at national level.

## Next Steps

The actions set forth by legislation that regulates innovation in Brazil and TTOs evolution, representing instances of those actions, have shown promising results.

As previously mentioned, there is no doubt that the institutionalization of innovation management, mainly after the Technological Innovation Law, was an important landmark for a more structured development of actions for university-company-government interaction.

Such evolution represents not only by the number of TTOs created since 2004, but it is above all an important reflection of the cultural shift that is taking place in Brazilian universities and research institutes by introducing intellectual property and technology transfer management in their institutional routine. This change is providing an increasingly greater participation of Brazilian universities and research institutes in intellectual property protection, as confirmed by INPI data, which shows exponential growth in the number of patents filed by those institutions.

But that quantitative growth in intellectual property protection still would not mean much if it were not followed by actions to transfer to society the knowledge produced, which, after all, is one of the missions and reasons for the existence of universities and research institutes - produce knowledge for the public benefit. That is also the essence of the TTOs mission. From this datum an important evolution can be noticed, which is consolidated by the licenses agreed upon and the volume of royalties obtained, meaning that the objectives of taking to market the knowledge produced at the universities and research institutes is gradually being achieved.

In order to meet the desired levels of technological innovation in the country, there are many challenges to be addressed. The initial duty of the universities and research institutes is to continue intensifying research activities to ensure results that can be transferred to the production/public sector.

As to the companies, there is a need to create conditions for greater investment in innovative activities. There is the need to pursue a greater balance in intellectual property and technology transfer negotiations aiming at a win-win strategy, which will only be reached when companies perceive the solid benefits of integrating with the universities and research institutes.

From the point of view of government actions, measures are still needed to enhance the performance of universities and research institutes.
Furthermore, it is necessary to continue investing in improving the national intellectual property system, particularly the INPI, for a more efficient response to intangible asset protection demands.

Another critical government role is to continue investing in economic subsidies to companies, and sharing with them the risk of experimental development of embryonic technologies with the purpose of getting them closer to the industrial scale, and therefore making them more attractive for appropriation by the corporate sector.

Lastly, it is important to acknowledge that the Innovation Law has produced much advancement in the national regulatory framework, although adjustments still need to be made to fully obtain all possible benefits. The number of projects conducted in partnership between universities and research institutes and companies is growing, but the major challenge remains to obtain practical results from the RD&I projects in terms of new products/ processes placed in the market.

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# BRAZIL: RECENT PUBLICATIONS

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In this article we present a sample of interesting publications relating to innovation in the Brazilian and Latin American context.

Two books deal with university-industry relationships in Brazil. The first provides a historical overview, and the second presents a sectoral approach, focusing on the pharmaceutical industry. A third book is a collection of contributions presented at the 2009 Seminar on the Triple Helix in the Latin America, organized in two main directions: knowledge generation, transfer and application; University-industry-government relationship, and the global crises challenges.

The fourth publication is a book detailing the results of a five year research project, entitled UniDev, which comprises comparative case studies in thirteen countries on the role of academic institutions in innovation and development. There is a chapter presenting the results of the Brazilian team's research.

The final publication is a recent book which focusses on the Triple Helix in developing countries. The book presents interesting insights, especially the two chapters on the Brazilian experience: one analyzing the regulatory system that rules the relationship between universities and enterprises, and the other presenting a comparative study between Brazil and Mexico on the business incubator movement.

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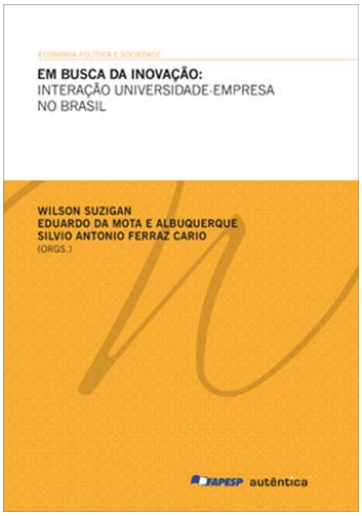



***In search of innovation: university-enterprise relationship in Brazil***

***Original title: Em busca da inovação: Interação universidade-empresa no Brasil. Belo Horizonte – MG: Editora Autêntica 2011. 461 pgs.***

***Authors: Wilson Suzigan; Eduardo da Motta e Albuquerque; Silvio Antonio Ferraz Cario (orgs)***

The capacity to innovate is vital to technological catching up processes which, in turn, depends on innovation systems for support. Universities and public research institutes, on the one hand, and firms on the other, are two of the most important components of the national systems of innovation (NSI). The interaction between them, along with government policies, are essential for NSIs to succeed in promoting economic and social development. This is the analytical background of this book.

The starting point is a historical overview of the development of higher education and research institutions in Brazil, as well as a bird's-eye view of industrial development in the country aiming to offer a long term perspective of the construction of scientific capabilities and the demand for new technologies by the productive sectors'. Scientific capabilities of institutions and interacting firms are studied on the basis of information from the Directory of Research Groups of CNPq, the National Council for Scientific and Technological Development.

Results discussed at national and regional levels and case studies show that there is cross-fertilization between science and technology, and that the role of universities and research institutes has been underestimated in the Brazilian NSI.


***Industry-university interaction in the Brazilian pharmaceutical system of innovation***

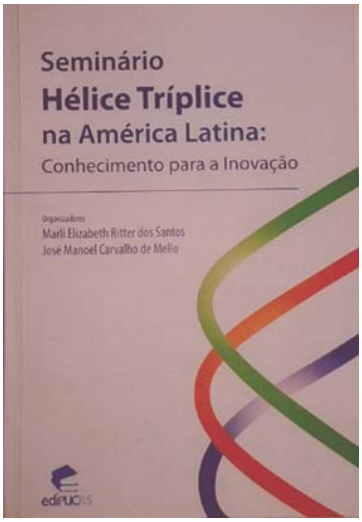
***Original title: Interação entre empresas e instituições de ciência e tecnologia: o caso do sistema farmacêutico de inovação brasileiro. Rio de Janeiro: EdUERJ, 2012. 340 pgs .***

***Author Julia Paranhos de Macedo Pinto***

Julia Paranhos (Eduerj, 2012) presents a recent analysis on the interaction between industry and university in the pharmaceutical sector in Brazil based on wide and extensive research. The method applied was a double case study on the industry-university interaction in Brazil and the UK, based on the three most important approaches to industry-university interaction - Triple Helix, Latin American framework and System of Innovation. Differences and similarities were analysed in both countries, aiming to find learning elements that might help the improvement of the Brazilian industry-university interaction.

The field work consisted of interviews carried out with important actors in both countries, e.g. national and foreign companies, universities and research institutions, government institutions and other actors related to the sector. The interviews were mainly about the characteristics, motivations, obstacles and strategies to the interaction, but included other important topics related to the sector, as regulation, intellectual property, funding, public policies, the development of biotechnology and biodiversity, foreign trade and prospects of the future of the sector.

The book identifies a series of obstacles and motivations that would make industry-university interactions effective in their contribution to innovation. It elucidates controversial topics as well as contributes to the design of future public policies in the area. Because of the comprehensive nature of the work, the potential audience includes those interested in the Brazilian pharmaceutical sector, including researchers, students, businessmen, policy makers and people who work in the sector.



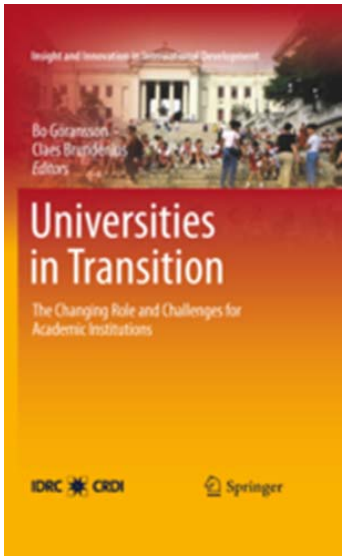

***Proceedings of the Triple Helix in Latin America Seminar: Knowledge for innovation***

***Original title: Seminário Hélice Tríplice na América Latina: Conhecimento para a Inovação. Porto Alegre – RS: EdiPucRS 2010. 237 pgs.***

***Authors: Marli Elizabeth Ritter dos Santos; José Manoel Carvalho de Mello (Orgs)***

The Seminar on Triple Helix in Latin America took place at the end of October, 2009 with over thirty speakers from Brazil, Argentina, Chile, Venezuela, Colombia, Peru and Mexico. The aim of the seminar was the discussion of the university-industry-government relationship from a Latin American perspective. The seminar was organized in two main directions: 1) Knowledge generation, transfer and application; 2) University-industry-government relationship and the global crises challenges. There were seven panel sections discussing the two main themes of the seminar.

A compilation of the main conclusions of the seminar was published in 2010 in the book "Proceedings of the Triple Helix in Latin America Seminar: knowledge for innovation".




***Universities in Transition: The Changing Role and Challenges for Academic Institutions.***

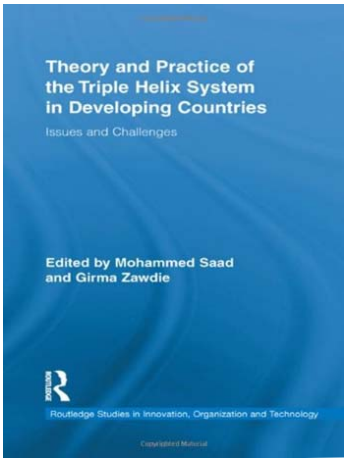
***New York: Springer, 2011. 366 pgs.***

***Authors: Bo Göransson; Claes Brundenius (Eds.)***

This book is the result of a research project focused on the analysis of the evolution of academic institutions in the contexts of innovation and economic growth and development, The research project, called UniDev Project, began in 2005 and was coordinated by the Research Policy Institute from the University of Lund in Sweden. The research involved twelve countries selected for coordinating the project - Brazil, China, Cuba, Denmark, Germany, Latvia, Russia, South Africa, Sweden, Tanzania, Uruguay and Vietnam-through teams national research.

The Brazilian chapter presents an overview of the national higher education system and it's relation with innovation and development. The analysis is focused in the evolution of the Brazilian higher education system, and the assimilation of the research and innovation missions in it. Other topics such as inequalities of the system, its quality and new proposals for the future are addressed in the article.

*Brazilian Chapter: Brazil: Universities and their contribution to innovation and development. Pgs 80-105*
*Authors: José Manoel Carvalho de Mello; Anne Marie Maculan; Thiago Renault.*




***Theory and Practice of the Triple Helix Model in Developing Countries: Issues and Challenges***

***London: Routledge, 2011. 311 pgs***

***Authors: Mohammed Saad; Girma Zawdie (Eds)***

Theory and Practice of Triple Helix Model in Developing Countries contributes to the expanding literature on "triple helix" innovation - focusing on developing countries. The book is based on practical cases and experiences from Africa, Latin America and Asia. Relevant experiences and best practices from developed countries are also examined. The book presents two chapters about Brazil:

*A new regulatory framework for the relationship between university and industry: the Brazilian experience. p91-112.*
*Authors: Anne Marie Maculan; José Manoel Carvalho de Mello*

*The Incubator Movement: a Comparative Analysis of Brazil and Mexico. p. 176-189.*
*Authors: Mariza Almeida; Branca Terra; M.P. Hernandez*

# BRAZIL: FACTS AND FIGURES

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Brazil covers an area of 8.5 million square kilometers, has a population of 196.7 million [1], and a Gross Domestic Product of US$ 2,425,052,000 billion [1]. It is organized as a Federal Republic, with twenty-six states, and shares borders with ten of the twelve countries in South America.

The country has abundant reserves of minerals, oil and gas, an immense river system for generating energy and transporting cargo, forest reserves, and a rich diversity of fauna and flora. The population is largely a mixture of the descendants of the indigenous people with Europeans, Africans, and Asians, and has developed a unique and rich cultural heritage. It is the only country in the region that has Portuguese as the national language.

Exports in 2012 were US$ 242,406,000 billion (Banco Central, 2013). There is no available data on export distribution in 2012, but the 2011 exports were distributed: high tech 3.7%, medium-high technology 16.7%, medium-low technology 15.3%, low technology 24%, and non-industrial products 40.2% (Banco Central, 2012).

The average number of years of schooling for the population is 7.2 years (IBGE, 2011). However, 4.3% of children of school age are not in school. There were fewer than 100,000 students enrolled in university level courses in 1960, but by 2005, the numbers had risen to almost four million.

Brazil has a Gini Index [3] of 0.501 and is ranked 10th in the world, among countries that have the poorest distribution of income. The Human Development Index in 2011 is 0.718, with Brazil ranked 85$^{th}$ in the world. Between 1980 and 2011, Brazil's HDI value increased from 0.549 to 0.718, an increase of 31.0 per cent or equivalent to an average annual increase of about 0.9 per cent (UNDP, 2011). The Brazilian position in the WCY ranking is 46$^{th}$ (IMD, 2012). Income inequality in Brazil has been declining since 2001. Between 2001 and 2009, the income per capita of the wealthiest ten percent increased by 1.49% a year, while the income of the poor grew at a rate of 6.79% per annum [4].

The unemployment rate was 5.5% in 2012, the lowest rate recorded since 2002 (IBGE). About 21.4% of the population live below the poverty line, and more than 13% are considered indigent (World Bank, 2012). The inflation rate (consumer prices) is at 5.7% (Banco Central, 2012).

The number of Brazilians with Internet access grew by 14.7% between 2009 and 2011, reaching 77.7 million people who are more than ten years old (PNAD, IBGE, 2011). One of the things that may have contributed to this increase was the rise in durable goods, such as computers with Internet access and mobile phones. During this period, the growth in accessibility was 39.8%. PNAD shows that 22.4% of the country's 61.3 million permanent private households have a computer with Internet access. Brazil ended 2012 with 261.8 million mobile phone accounts and a density of 132.69 per 100 inhabitants (Anatel, 2012).

## R&D INDICATORS

### *(a) Input Indicators*

The R&D intensity is at about 1.6% of GDP (MCTI, 2010). This total includes public and private resources and is much lower than the OECD average. Approximately 2/3 of the costs of developing science and technology in Brazil are covered by public funding. About 80% of the research projects are developed in public universities and other institutions.

In 2010, the budget for the Brazilian Ministry of Science, Technology and Innovation amounted to approximately R$7.6 billion (£2.8 b). This includes funding for facilities and doctoral level training, but excludes state-level funding. The total number of researchers was 234,797 in 2010, distributed as: 7,667 - government; 188,003 - universities; 41,317 - industry; and 1,013 - not-for-profit organizations.

The Lattes Platform is an information system for research in Brazil, maintained by the National Council for Scientific and Technological Development (CNPq), affiliated to the Ministry of Science, Technology and Innovation. Its central element is a freely-available database of the résumés of Brazilian researchers and professors, who are encouraged to keep their data updated. In 2012, of the 100,740 doctorates in the activities of research and teaching registered in the Curriculum Lattes database, 46% were women and 54% were men. The distribution of this total within the eight fields of knowledge recorded by the Brazilian government is: agrarian sciences - 9.98%; biological sciences - 12.79%; health sciences - 14.99%; mathematical and earth sciences - 14.46%; social sciences - 15.91%; applied social sciences - 9.53%; engineering - 9.38%; linguistics, literature and the arts - 5.89%; and information not provided - 7.47%.

### *(b) Output Indicators*

Brazil has one of the strongest scientific bases outside the OECD. Among developing countries, its scientists contribute more of the most-cited research papers than any other country except China and India.

Brazilian scientists published 32,100 scientific articles in journals indexed in the Thomson Reuters Science citation index in 2009. In 2011, 46.933 scientific articles were published in journals indexed in Scopus. As a result, the country is the world's 13th-largest producer of scientific research. More than 90 percent of these articles were generated by public universities. According to Thomson Reuters, Brazil produced the world's most cited article in 2009 (on medicinal plants).

The number of doctoral degree holders in Brazil in 2011 was 12,217. In the same year, the number of students that completed their academic master's degree was 39,220, and professional masters numbered 3,610. The number of science PhDs granted has grown by an average of 12% per year over the last decade.

Evidence from Thomson Reuters indicates that the impact of Brazilian science is significant relative to global production in the following areas: Tropical Medicine (18.4% of world share), Parasitology (12.34), Agriculture (8.61), Oral Surgery and Medicine (8.19), Entomology (7.06) and Animal Sciences (6.49). Bioenergy is another important topic. The proposal is to network key academics in these areas, with a view to generating joint research proposals.

The total number of Brazilian patents filed and granted in USPTO grew 100% in the period 2001 to 2011, where patents filed rose from 219 to 586 and patents granted passed from 125 to 254 (source: CGIN / ASCAV/SEXEC/MCTI). In the period 2001-2010 the owners of the greatest number of innovative Brazilian patents are presented in the Table below showing the prominence of Brazilian universities:

| Document Count | Patente Assignee |
|---|---|
| 415 | Petrobras - Petróleo Brasileiro SA |
| 394 | Campinas State University - Unicamp |
| 235 | University of São Paulo - USP |
| 143 | State of São Paulo Research Foundation |
| 139 | Federal University of Minas Gerais |
| 125 | Semeato Ind & Comércio SA |
| 88 | Maquinas Agric. Jacto SA |
| 84 | Vale do Rio Doce Company |
| 81 | Usiminas - Usinas Sider. Minas Gerais |
| 79 | National Nuclear Energy Commission |

Source: Thomson Reuters Derwent World Patents Index (DWPI)

In the same period the top five technology areas, in terms of volume of published applications and granted patents were digital computers, industrial electric equipment, automotive technology, domestic appliances, and natural pharmaceutical products (source: Thomson Reuters Derwent World Patents Index - DWPI). In 2011, 27% of all patents in Brazil were owned by universities (source: Thomson Reuters Derwent World Patents Index - DWPI).

#### UNIVERSITY-INDUSTRY RELATIONSHIP

According to a study conducted in 2011 by Anprotec, in partnership with the Ministry of Science, Technology and Innovation (MCTI), Brazil has 384 incubators in operation, housing 2,640 companies and generating 16,394 jobs. These incubators have generated 2,509 enterprises, that today have revenues of R$ 4.1 billion and employ 29,205 people. The same study revealed another important fact: 98% of incubated companies innovate, and 28% focused on the local, 55% nationally and 15% globally. In 2012 there were 88 technology parks in the country, which represents an increase of almost 20% in four years (CDT / MCTI, 2011).

The Innovation Law, passed in 2004 and regulated in 2005, requires the Scientific and Technological Institutions to create "Technological Innovation Nuclei" (Núcleos de Inovação Tecnológica - NIT) that, among other things, will be responsible for the management of the technology generated by researchers, with special attention to decisions regarding intellectual property and licensing. In 2011 there were already 165 scientific and technological institutions that have implemented or were in the implementation phase of their NITs (source: MCTI, FORMIC 2011).

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[1] IBGE, est. July/2012.
[2] Ministry of Finance, 2012.
[3] A value of 0 represents perfect equality of distribution and 1 perfect inequality (IBGE, 2011).
[4] Nery, Marcelo Côrtes (Coord). **A nova classe média: o lado brilhante dos pobres/ The new middle class in Brazil: The bright side of the poor**. Rio de Janeiro: FGV/ IBRE, CPS, 2010.