

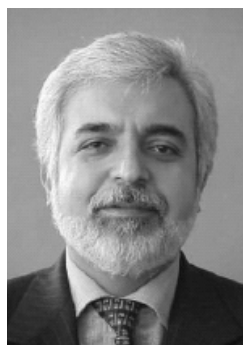
Intellectual property and innovation in agriculture and health

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Abstract

Intellectual property has come to assume an ever more important role in modern societies, whose development is associated with technological progress and the creative and entrepreneurial capacity of individuals and businesses. The present and future vector of development is innovation in all its dimensions – including the reinvention of the life styles of wealthy societies whose expansion is clearly unsustainable. In this sense, the present work's purpose is to demonstrate that Brazil has created an institutional brand suitable for the intellectual property protection, however, that brand is only one condition, in some necessary sectors, but not enough, to promote innovation. It needs, more than appropriate rules, to develop the capacity to innovate and create an innovation friendly environment. Intellectual property is only one, without doubt important, element of this complex system. It has taken agriculture to illustrate how intellectual property needs to be followed up by investments in human resources, local training, business demand, private-public interaction, in order to yield fruit and promote the country's development.

Keywords

economic development; research and development; intellectual property; agriculture and health

Introduction

The economy and world society have come through a period of great transformation which have modified, at times in a radical way, the paradigms and dynamics which have characterized evolution in last 50 years. At same time in which society continues a passive human development in order to resolve itself, it is confronted with new challenges – such as the environment and power

generation – and with a renewed demand related to problems of poverty, hunger and disease which affect billions of people around the world. The present and future vector of development is innovation in all its dimensions – including the reinvention of the life styles of wealthy societies whose expansion is clearly unsustainable.

In this context of reorganizing capitalism, the growth and power sources dislocate from natural resources and physical capital for the dominion of knowledge, whose

control and application are ever more essential to assure the survival of mankind and the improvement of quality of life. In summary, Science, Technology and Innovation (S, T & I), knowledge and information products, are the principal propulsion mechanisms of economic development and modern society.

Economic and social progress require a constant flow of new ideas and products to improve life conditions and the effective and efficient use of increasingly scarce and precious resources. New products and processes are also important for the regeneration or substitution of industries in decline and, in consequence, for the full employment of productive sectors of an economy. It is not only about assuring microeconomic competitiveness, but also about creating an environment and an institutionality in order to assure the sustainability of life on Planet Earth.

As a result of these factors, many countries have designed and implemented policies in order to stimulate creation and invention, not only in scope of large corporations, but also in small to medium enterprises as well as individual inventors. The importance of invention and innovation in economic development has been recognized by industrialized and developing countries. For industrialized countries, they represent the search for more competitive solutions and means in order to overcome the ever increasing cost of natural resources and raw materials. Regarding developing countries, those who prioritize innovation policies in order to reduce technological delay have reached satisfactory levels of social development.

The diffusion of knowledge and stimulation of inventors and innovators was the basis of the appearance of a system of intellectual property protection, whose effectiveness depended, from the beginning, upon recognition within the international scope. In fact, intellectual property played an important role in the construction of the development of modern industry in developed countries, and is placed today as an increasingly central piece of new institutionality in construction.

Intellectual property has come to assume an ever more important role in modern societies, whose development is associated with technological progress and the creative and entrepreneurial capacity of individuals and businesses. Currently three factors have contributed to highlight the importance and value of intellectual property across the globe. The first being its political visibility, not only associated with the intrinsic value of intangible assets as well as the difficulties encountered in assuring the effective protection of property rights of holders of intangible assets. The second is the value and importance of **incorporeal personal property** which are superior to personal and fixed assets which constitute the principal component of patrimony from individuals and business up until recently. It is not uncommon for incorporeal assets of large corporations to be more valuable than the sum of their material assets. The third refers to the value of ownership and meaning of intellectual property, questioned often by segments of society as an

unjustifiable source of political power and the economics of corporations and developed countries. In this sense, debates evolve around the last generation's access to medicine and the rise in food prices, necessarily, through the subject of intellectual property.

According to Buainain and Carvalho (2000) "intellectual property enables the transformation of knowledge in principle of a quasi-public in private good and the bonding link between knowledge and the market well. The intensity of scientific and technological development, the handling and interpenetration between science and technology (market science approached in a new way), the dramatic time reduction required for technological development and the incorporation of results into the production process; product life cycle reduction in the market; the rise in research and development costs and the implicit risks in the technological option; the incorporation of innovation as a magnifying element in competitiveness; and, particularly, the capacity of knowledge codification which increases the importance of intellectual property protection as a mechanism of guaranteeing rights as well as to stimulate investment".

Alterations in the economic, regional and global politics and the advent of new technologies, biotechnologies have especially provoked a true revolution in intellectual property systems which have conformed throughout the XX century in a large number of international agreements and treaties and were consolidated into the scope of the Uruguay Round of GATT negotiations (*General Agreement on Tariffs and Trade*) which was started by the WTO (World Trade Organization). The final agreement from the Uruguay Round imposes signatory countries stricter rules regarding intellectual property, consolidated into TRIPs (*Trade-related Aspects of Intellectual Property Rights*), which defined deadlines for signatory countries to adjust national laws which regulate matter of principles and rules established in international treaties.

TRIPs' establishment meant a radical change in the intellectual property system's institutionality, not only as a way for innovating in issue of principles and doctrine — a great many of which only reproduce concepts established in previous treaties — however principally for creating an *enforcement* mechanism for principles and rules absent until then. In this context after TRIP, the possibility of commercial retaliation or exclusion from important negotiations in international markets, which brought developing countries to approve, in shortest time possible, new legislation regarding intellectual property in all areas, of this industrial property up to the rights of the improver.

Haste in taking decisions nor has always allowed a debate focused on subjects most polemic in question, and which considers outstanding economic, social and cultural differences existing between developed nations and those in development, especially in when referring to the wealth of biological diversity, mainly found in tropical climate in developing countries.

Intellectual property, previously strongly associated to industrial production and artistic works, expanded

itself to the set of activities of the fruit of creativity and human ingenuity. What are the regime implications of intellectual property to the dynamics of technological innovation in Brazil? Although Brazil has much activity internationally, attempting to find flexibility and spaces to brighten up the effects which may be favorable in agreements and searching for more interesting solutions for less technologically active countries, which is its capacity for constructing innovation? These and other questions need to be approached in context of the current institutional brand, recognizing its duration completely, searching to understand imposed restrictions, opportunities eventually created and, principally, requirements in order to take advantage of opportunities such as to reduce disadvantages in the new context.

In this sense, the present work's purpose is to demonstrate that Brazil has created an institutional brand suitable for the intellectual property protection, however, that brand is only one condition, in some necessary sectors, however it is not sufficient to promote innovation. It needs, more than appropriate rules, to develop the capacity to innovate and create an innovation friendly environment. Intellectual property is only one, without doubt important, element of this complex system. It has taken agriculture to illustrate how intellectual property needs to be followed up by investments in human resources, local training, business demand, private-public interaction, in order to yield fruit and promote the country's development.

Intellectual property's role and evolution in Brazil

The conception of property has been developed from the most primitive times having as its conducting wire of demarkation of surviving spaces and of the rights regarding the means of production and power of communities. In this trajectory mankind learned how to better understand nature, how to dominate fire, water, establishing rules of cohabitation with fellow humans and developed institutions to facilitate and assure social reproduction. Property was elevated as a fundamental institution of social organization since man became sedentary.

Technological advances, in modern capitalist societies had above all revolutionized the division and specialization of work, the creation process and production of new goods. Explaining the radical separation between intellectual work and non specialized manual or physical work. During conception of the first ones, *intellectually*, products to be launched from industry assembly lines, to laborers responsible for repetitive and non creative tasks to give physical life to the creation of inventors and innovators.

The market and competition are not enough, by themselves, to assure the appropriation of generated wealth, and economic relations come to be mediated by contracts and institutions that have the protection of rights of some involved agents, the reduction and mediation of conflicts and lowering of transaction costs

in general as their purpose. The competitive strategy of companies incorporate the differentiation based on creation and development of "signals" and "brands" of a distinctive expression for their products and their own identification for consumers. It was necessary to individualize and characterize each company against of set of consumers and in face of their own competitors (Vieira & Buainain 2004).

In this context, property rights grows in importance, which includes a complex set of economic, legal and social relationships between which property over incorporeal personal property. Thus, rules to protect different productive processes in ever more broader and impersonal markets become internationally agreed and introduced in different rhythms in some countries. In recent times, becomes stylized as "globalization", it is not only necessary to protect rights, but also to homogenize mechanisms and grasp the granted protection.

Throughout history property has assumed more varied features, from its manifestation in most primitive phases, up to its most complex forms and which require specific regulations which enable legal, formal disciplines of diverse types of assets and values appropriation, including the ones without tangible existence.

The development of industrial economies began to require the creation of new property rights categories: Beyond land based and product property, for the good operation of the economy it became necessary to also recognize exclusive rights regarding the concept of production, or even, regarding the concept which allows a product's reproduction. These rights are given the name of intellectual property. However, the intellectual property segment which directly affects industry's interest in transformation and commerce, such as rights relative to brands and patents, is called "industrial property". Although tradition has reserved the word "property" to have control over things, tangible assets confirm the concepts and use of intellectual property, industrial property, commercial property, etc. to describe the rights exerted over certain intangible assets.

Conceptually, the objective of intellectual property is to promote scientific and technological progress of applied arts, through the concession of temporal monopoly of the right of economic exploitation of property, as well as hindering that which, without economic authorization or profits for the inventor, uses an invention for commercial purposes. However, in practice, this system, although protecting the inventor's rights partially, does not resist a series of factors that, in fact, lead to the loss of these rights (Dal Poz & Barbosa 2008). On one side, it is also recognized that in many situations, independent of the effectiveness of protection, the bond between intellectual property and scientific and technological development is not so immediate and clear.

Intellectual property is composed by several regulatory systems which include the protection of industrial property, incorporeal intellectual properties and rights (*sui generis*), such as the protection to cultivate, protection of computer and protection of integrated circuits.

Such as Chamas et al. (2007: 1565) demonstrate, Brazil quickly adjusted its legislation to trips: “Further relying on TRIPS, Brazil introduced a new legislation for authors’ rights (the Authorship Rights Law of 1998 (Law No. 9610), a Computer Programs Law of 1998 (Law No. 9609), and the Plant Variety Protection Law of 1997 (Law No. 9456). The latter aims to encourage private investment in plant breeding. The law is widely perceived in Brazil as a radical change with regard to the protection of IP)”. The challenge still is to use the protection system to promote the generation of knowledge and innovation.

Intellectual property and innovation: agriculture and health

Intellectual work is becoming more and more intense and valued by society. Although Brazil holds a position of prominence in some economic sectors, within agriculture, and registers positive performance in some areas of science, the country is losing ranking position in technological innovation when compared with other emergent economies, at least where the number of patent requests is considered (Figure 1).

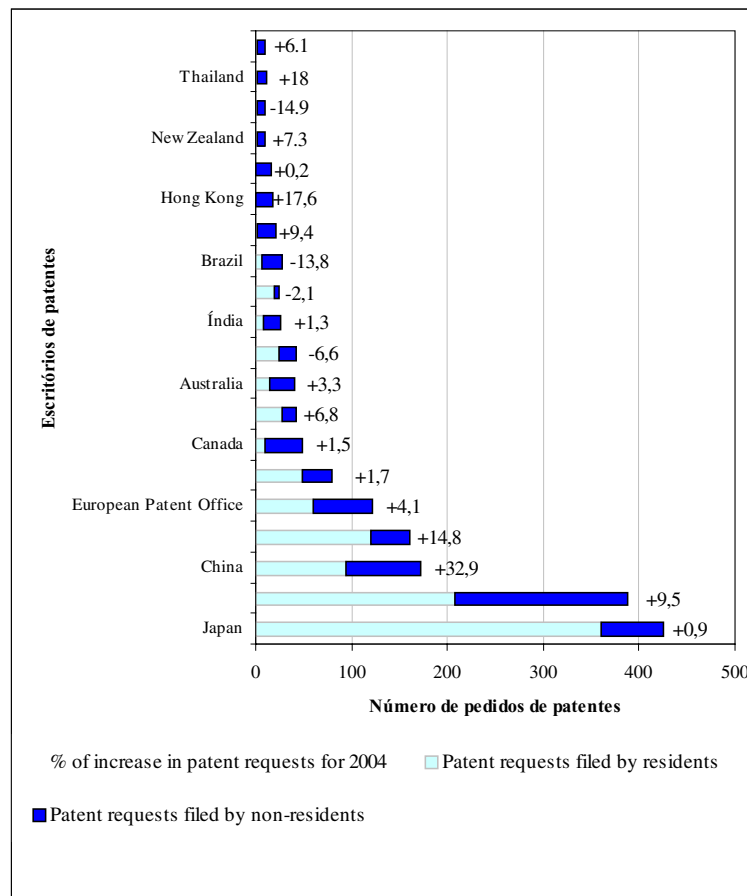


Figure 1– Number of patent request of various countries.

Source: OMPI¹

Although Brazil occupy 13th position in ranking of twenty larger patent offices around the world, in 2005 it was behind other emergent BRIC countries –Russia, India and China. China, who antagonized intellectual property until the mid 90s, today occupies third position, in front of South Korea and the European Office of Patents. Furthermore, patent requests in China, Russia and India presented growth of 32.9, 6.8 and 1.3%, respectively. Contrary to this evolution, INPI (Brazilian Patent Office) had the greatest reduction (-13.8%) amongst twenty analyzed offices. The OMPI report also reveals that, at 24%, Brazil has the lowest percentage for domestic patent requests. India, with 37%, China,

with 54% and Russia, with 73% represent a significant national innovative dynamism. The report informs further that around 600 thousand patents were awarded in 2005, increasing to 5.6 million the total of effective global patents for that year.

Until recently its own Government lived with indifference and in ignorance regarding the subject of intellectual property, with reflections of rights regarding the INPI’s operational capacity and its isolation from other initiatives in favor of innovation coming to be implemented, evenly lightly, from the end of the previous decade. The indifference coexisted with an exaggerated politicalization in the debate regarding intellectual

property, transformed by some into battle horse against globalization, neoliberalism and against the property of the “capitalist system”. The fact is that these numbers show that Brazil’s knowledge has not transformed into wealth with the same intensity as other countries.

According to data from the Institute of Innovation², a private company who operate innovation and technology management, while Brazilian patents correspond to only 0.2% of the global total, Brazilian published “indexed articles” correspond to 1.7% globally, slightly below, however, compatible with a 1.9% Brazilian GDP of Global GDP. This demonstrates the need strengthen innovation policies, including the intellectual property component, to incorporate knowledge generated from development.

Brazil’s best example of knowledge generation in innovation is Embrapa, which confirms advantages suitable to the requirements of new innovation environment to exploit development opportunities which benefit society as a whole. It is certain that construction effort for Embrapa is previous to current validity of the current institutional brand which values the intellectual property of intangible assets, however, it is important for the argument which is the capacity construction to innovate did not divorce evolution from the institutional brand, and that in the place to react “against”, it knew how to take advantage of the opportunities and potentialize the innovation capacity.

The appropriateness given at the time where intellectual property began to address several international themes and the protection of product and process innovation became an essential instrument for the strategical actions of research companies, as in the case of Embrapa. The first step was update itself in relevant legislation, in the case of Cultivation Law Protection, which Embrapa actively participated in.

In the context of the internalization of rules contained in TRIPS, Brazil’s cultivating protection is regulated by Law No. 9,456, April 28th 1997, “which is effected by granting a Cultivation Protection Certificate, considering movable assets for all effects of protection and the only form of protection to cultivate and the right that could hinder the free commercialization of plants or their reproduction or vegetative multiplication parts in the Country”, for a determined term, an exclusive right as well as a Decree which is regulated by No. 2366, November 5th 1997 (Vieira et al. 2007).

The object of warded protection through the right of the improver and cultivation, which is the variety of any genre or superior vegetable species is the right is to cultivate, that it is variety of any sort or superior vegetal species that are clearly distinguishable from other cultivation known by minimum bank of descriptions, for its own denomination which is homogeneous and stable. According to norm, new cultivation or essentially derived cultivation may be protected.

Furthermore, the altering scenario and uncertainties from the advent of biotechnology provoked the need for the strategical repositioning of public research in Brazil. Embrapa, in compliance with this new scenario,

it looked to adjust itself, in view of the Brazilian System of Genetic Improvement and Cultivation Development offered protection and operated in a markedly stable environment. Until agricultural research was considered a public good, which benefited society in general, without generating resources and rights for the entity which develops new technology.

New legislation and the new context of public research caused Embrapa to create the Ministry of Intellectual property, whose principal purpose is to promote the management of its intangible assets, evermore valuable, and to internally develop a culture of protection of its technologies, demystifying the subject of intellectual property as an incompatible instrument with its public functions. In contrast, intellectual property comes to be, in many cases, a condition in which Embrapa plays its role of leading business in the area of agrobusiness. In particular because protection increases a business’ negotiation power, it enables partnerships to seed and allows important returns for company and country.

Embrapa’s global leadership in the development of technologies applied to agriculture in the tropical climate, adapted to various ecosystems in domestic territory, indicates that the adequate treatment of intellectual property systems allows the promotion and divulgation of knowledge and innovations in a safe way, had consequences on intellectual property protection, a strategical instrument of knowledge and innovation management, where the business became a reference. Embrapa’s leadership in the development of new technologies applied to agriculture in a tropical climate also has consequences in the intellectual property protection, where the business became a reference. Between 1996 and 2006 the company deposited 190 patents requests, 191 brand registrations, 25 software registrations in the INPI. And it registered 65 patents and one brand internationally. Regarding cultivation, in same period 277 cultivations were registered in Brazil and 19 abroad. In last seven years Embrapa performed about eight times more deposit requests than in the previous nineteen years to the implementation of its Intellectual Property Policy. Currently, intellectual property consolidates and strengthens Embrapa’s position of prominence on the domestic stage, relying on a technological portfolio of 129 granted patents, 168 registered brands, 30 software registrations and 297 registered and protected cultivations in Brazil. Internationally there are 89 patents, one registered brand and 19 protected cultivations.

In its current staff scenario of 8,320 employees, 27% are researchers. Of these, less than 1% are non-post-graduated researchers while 7 and 19% are researchers, respectively, with a masters and a doctorate (Figure 2). As labor training, notably post-graduated, has a considerable overflow effect to other sectors (Salles Filho 1993), Embrapa’s effort, as well as enabling company to face its challenges in Research and Development (R&D), lends a strong contribution to the country’s development, notably in its less regions favored.

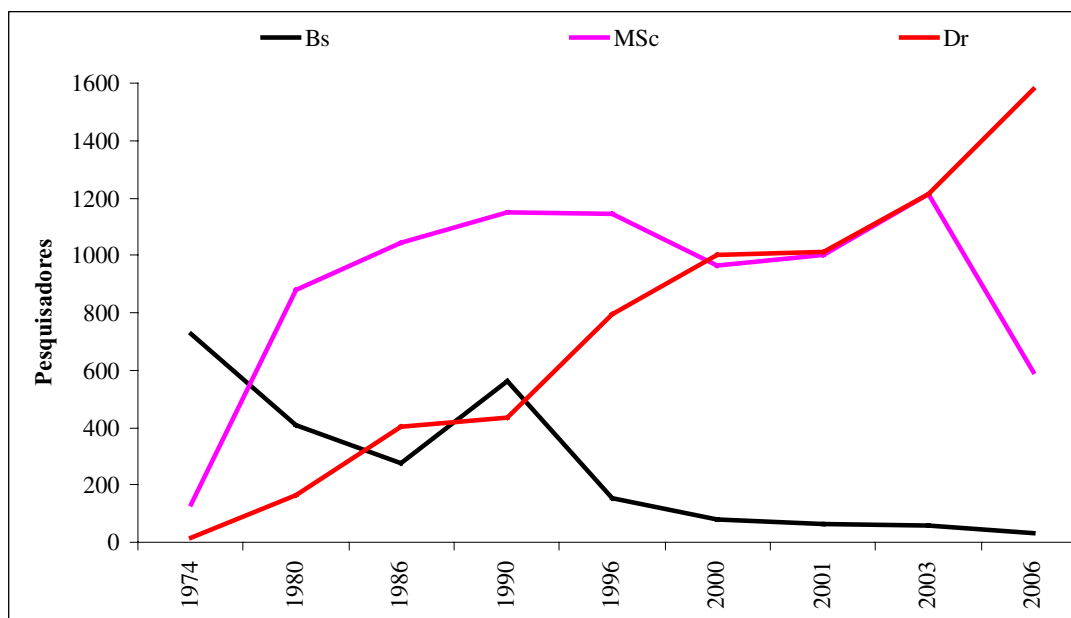


Figure 2 – Evolution Embrapa’s staff of researchers with graduation, masters and doctorates (period 1974 to 2005).

Source: Embrapa

In the area of health, the TRIPs Agreement has been the object of intense controversy that is not worth repeating here (Carvalho & Buainain 2005). Our point of view is that the Agreement was never placed as a barrier to health access even because the most serious health problems which affect world’s poor populations are associated to property poverty and find treatment with drugs efficient that are no longer under the monopolistic control of the innovator. Furthermore, the Agreement foresees that countries must assure the implementation of public health policies, to avoid resource of ambiguous clauses of the Agreement in order to obtain highly restrictive interpretations which reduce the choice of available options to governments in promoting and protecting public health. But it is fact that the Agreement and intellectual property have been questioned and pointed out as responsible for high medication prices in the last

generation, that enhance the cost of treatment of some diseases which affect populations from poor countries.

In relative and absolute terms, Brazil is between global references, seen to possess centers of excellence in the health sector (biochemistry, biomedical and pharmacological sciences, the area of immunology directed at vaccination, in the area of genomics, and principally referring to tropical illnesses and the treatment of Aids). The basic competence of research in the health area is already installed; human resources of a higher level are available and institutional development is advanced. However, innovation in the health area requires high investment and a restricted interaction with the production sector. In the international scope, this part of development, guaranteeing significant investments and profits, is essentially done in large multinational pharmaceutical companies, as illustrated in Table 1.

Table 1 – Pharmaceutical sales of the top ten pharmaceutical firms and market concentration between 2000 and 2004

Firm	Sales (US\$ millions)	
	1999	2004
Pfizer Inc.	10.500	46.133
GlaxoSmithKline	16.164	35.000
Sanofi-Aventis*	12.598	27.311
AstraZeneca	14.834	23.950
Johnson & Johnson**	10.694	22.300
Merck & Co.	17.482	22.011

Cont.

Hoffman-La Roche	10.974	22.992
Novartis	12.698	22.212
Bristol-Meyers Squibb	14.309	19.207
Wyeth	11.695	18.755
Pharmacia	11.177	-
CR4 ³	48%	59%

Source: ETC Group (2001) and ETC Group (2005a) cited by Vieira Junior et al. (2007)

When Brazil's position in agriculture and health is compared the difference is significant. Firstly the country holds a prominent position, in economic terms as much as for technological ability and innovative capacity obtained. In the health area, the Fiocruz system is also very respected, having the leading edge scientific and technological capacity and is responsible for guaranteeing access to the principle assets, vaccines and drugs widely used by Brazilian public health policy. Nevertheless, it has no penetration and impact in the country's productive structure which is observed in relation to the stockbreeding research system.

The differences are explained in great measure by very different political trajectories applied in agriculture and the medicine industry.

In agriculture, the dominion of technology established itself in construction of endogenous capacity to innovate, which Embrapa has as the principal – however not unique – brand. Already the Brazilian medicine industry has developed, in the past, in a context in which facilitated the use of foreign technologies, and had no explicit concern in the development of an effective endogenous capacity of innovation on behalf of industry. In this way, with a change of paradigm, the adoption of new principles and economic reforms from the 90s were accelerated, national industry lost its competitiveness and was almost extinguished. In the most recent period it is rebuilding from the regulation of generics and the rise of public and private investments in R&D. In 2005, the medicine market turned over around US\$ 10 billion. Considering the entire globe, this number grows to more than US\$ 300 billion. It is exactly in this area, medicines, that the majority of institutions, patent requests related to Health are concentrated.

In Brazil, the current state of innovation in the medicine area has been recently impacted by the fact that most pharmaceutical industries who operate in the country are multinational companies with few deriving research patents in the country. It is probable that *pipeline* mechanism has affected the interest of some companies, which has contributed to generate controversies concerning this mechanism, however the effects of correctly accepting the *pipeline* by Brazilian legislation still needs to be better evaluated.

The intellectual property protection mechanisms are based for organization and management of knowledge

and technological innovation and to strengthen the institutionality of public research. They are party to the process which brought Brazil to cross the position according to world's largest food exporter, which significantly contributes to sustainability for the recent process of economic growth. However, the impacts that this example may initiate in the development of Brazilian scientific and technological research, in a general way, also depend on the countless other factors and may only be objectively evaluated in the long and medium term. Innovative drive depends, in a critical way, as much of endogenous capacity to generate and appropriate knowledge with the transformation into assets and services – public and private – and make them available to society.

Brazilian potential for the generation of knowledge to innovation

The experience has shown that the legal approval of intellectual property protection statutes, still necessary and indispensable in creating an environment of stimulated investment in innovation, is not itself sufficient to guarantee investments and much less a guarantee of positive results. Besides legal statutes, it is necessary to act positively regarding other factors which determine public and private investment, of macroeconomic stability to the infrastructure, and principally to create the necessary material conditions for the generation of knowledge and its transformation into innovation. Therefore they include from development to science, human resources training, strengthening research institutions, pure and applied, up to the incentive to businesses who transform knowledge into innovations and companies and end users who demand innovations produced domestically.

The difficulties are not small. According to Buainain and Carvalho (2000), the intensity of technological development, the reduction of time required for technological development and the incorporation of results into the production process; product life cycle reduction in the market; the rise in research and development costs and the implicit risks in the technological option are factors which create instability and increases the importance of intellectual property protection as a mechanism of guaranteeing rights as well as to stimulate investment.

However, these same factors relativize the effectiveness of legal *strictu sensu* protection instruments to assure eco-

conomic appropriation of innovation effort, which in the last analyzes determines investment decision of businesses.

Most important is not to simply protect for protection's sake. The best protection is efficient asset management, and given current conditions, management of intangible assets of intellectual property for the appropriation of its economic results is conditional to joint capacity between assets or other non passive intangible assets of protection (Buainain & Carvalho 2000).

In this sense, according to the placement of Bohrer et al. (2007), *intellectual property begins to be an element of increasing importance for socioeconomic development to measure which technological innovation takes the central place in competitiveness between countries that operate in a globalized scenario.* The subject, however, is not well understood, from the point of view of the application of protection mechanisms and regarding the formularization of economic policies in macro contexts and the definition of business management strategies, in the microeconomic sphere.

In Brazil, although having adequately regulated its brand in technological innovation using Law 10,973/2004, there is still "valley" between research and technological innovation, in other words, the market, because although the National Innovation System has conditions which approximate countries such as China, Italy and Spain, it is a long way off from OECD countries. In 2000 Brazil invested 1% of its Gross Domestic Product in R&Dⁱⁿ activities, however on average OCDE countries invest 2.2% of GDP, 1.4% coming from industry and 0.6% from Government. Beyond the bad distribution between public and private R&D spending, the total inversion of Brazilian SNI is, as noted, still very low to that observed for developed countries. They are characteristics that recede in an asymmetry which remits to the historical process of

Brazilian economic development, as shown in Borher's article et al. (2007).

Constantly the news highlights that Brazil has fallen in global ranking of the North American patents registration office (USPTO), overtaken by other emergent countries in last three decades. In the last three years, the only area which presented expansion is biotechnology-pharmacy, with a 54% growth, growing from 26 to 40 patents, principally the sub-area of cosmetic pharmacy, which jumped from 13 to 23 registrations, and agricultural and food products, which grew from 6 to 11 registrations. These results express industrial politics in recent years, predominantly for BNDES (National Bank of Social and Economical Development) and Finep, innovation promotion agencies in the area of pharmaceutical and pharmaceutical products.

However, even with these results, *start up* businesses, particularly in the biological and health area, needs to deal with issues of intellectual property. In this sense, there is a need to make some adjustments in Innovation Law, placing the country into a sustainable trajectory, which depends upon, principally, a rise in private spending, as well as better tax incentives and in removing bureaucracy so that Innovation Law is more efficient.

However, in last five years there has been an intensification in the country regarding the interest for intellectual property rights and academia/business cooperation. The formation of laboratory implantation and teams for the performance of research are onerous activities and carry high risk for business, currently being restricted to universities and research centers and being managed with public resources. However, the process of knowledge generation and transformation of this knowledge into wealth, even with some advances in recent years, are still very incipient, although increasing, as shown in Figure 3.

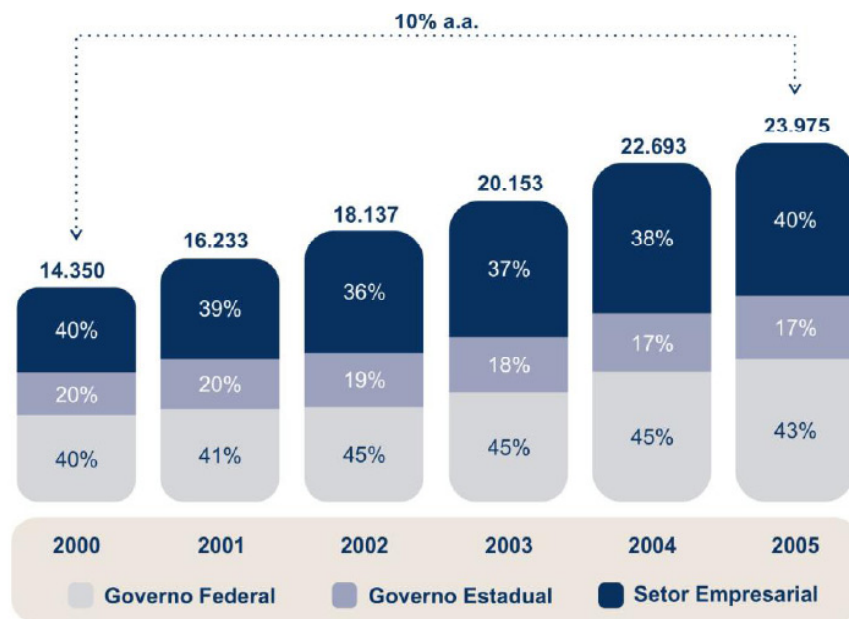


Figure 3 – Growth of S&T Investment (in R\$ millions).

Source: General Indicators Coordination – The Executive Follow-Up and Evaluation Advisory Board –Ministry of Science and Technology cited by Moreira et al. (2007).

Brazil has the potential for technological development, because beyond the process of constructing a pro-innovation environment, with a modern legal brand already in use, research institutions with an elevated capacity to generate knowledge with potential to support innovation, such as Unicamp, USP, Fiocruz, Unifesp, among others, and who have a technological and enterprise base in conditions to transform knowledge into innovations. The greatest challenge for businesses is the development of financing mechanisms adjusted for private R&D, whose risk and cost are high and end up favoring the technology import option to compete in goods markets which tends to devalue in the place of develop and to compete for more lucrative markets.

Unicamp, the institution with the greatest number of patents deposited in the INPI, holds 17% of domestic research, 10% of physicians in Brazil, 492 active patents in the INPI (16 Medical Sciences Faculties patents, 203 Institute of Chemistry patents, 19 Chemical Engineering Faculties patents and 16 of Institute of Biology patents)⁴, which up until 2007 only 7 patents had been granted. Since the creation of Inova (2003), already 186 technology transfer contracts have been solemnized (22% pharmacos, 6% physiotherapeutic, 12% medical area), 31 licensings of technology (58 patents and 3 Know-How), 16 deposits of international patents (PCT), 35 new brand deposits and 35 new software deposits. In Federal University of São Paulo (Unifesp), there are 23 deposited patents (up until 2005).⁵

Fiocruz is another institution with patent deposits since the end of the 80s. In 2005 it requested 115 patents, 51 being in Brazil and 64 abroad. Of this total, 54 have already been granted (40 abroad and 14 in Brazil)⁶.

Final considerations

In Brazil, since the TRIPs Agreement has come into effect it has caused a radical change in Intellectual Property System's institutionality, which has still not been sufficient for the promotion of technological innovation. Because, despite the country relying on R&D centers of excellence, such as Embrapa and Fiocruz, with international recognition, a "great valley" between science and the market still exists. However, for this knowledge to reach the market, it must have a greater awareness in the country on the part of business of the need of a greater interaction with knowledge centers. In this sense, intellectual property will comply with its objectives: favoring development, promoting the dissemination of knowledge, propitiating transformation of knowledge into value for businesses and consumers and, principally, stimulating agents to discovery, artistic creation and invention. However, despite Brazil walking a "turtle's" pace in relation to too other emergent BRIC countries, it has created some mechanisms which confer a greater dynamism to the domestic innovation system and which promote participation of national operators. The country's supply of scientific and technological knowledge, the existence of universities, public research

institutes, private research laboratories, governmental research, scientific and business periodicals, market research reports and data has enabled a greater appropriation and economic valuation of intangible assets.

However the natural competitive advantage of Brazil in industry by itself, does not generate wealth. If the country does not develop a technological commercial strategy, Brazilian natural resources will not stimulate domestic industry. It is important that Brazil closes the technological cycle, in other words, that it creates bridges between laboratories and the commercial element. It is of the utmost importance that products and services are produced which may be sold on a global scale. Therefore, adopting these mechanisms, it may be affirmed that research transforms wealth into knowledge and innovation transforms knowledge into wealth.

However, as much as endogenous development of Brazilian industry or that which comes to the cooperation of universities/business' is highly dependent on public resources, which is always insufficient and competed for by other priorities. The resources for Brazilian research in this sector still represent a small part of multinational business' investments.

It must be taken into account that the pharmaceutical sector is highly characterizes by being internationalized, which always results in interpretations of threat or opportunity. In the current globalized world, Brazil has little to gain if it continues seeing multinational business as a threat and not as a necessary partner to promote domestic development, being through investments made as subsidy for technology and access to international markets. Very probably it would be opportune to use to successful advantage Embrapa's experience in partnerships with domestic and multinational business, indistinctly, whenever it is in the interest of the country's needs. The partnerships desire the right to use third party technologies, through licensing, results sharing in proportion to the contributions of parties with benefits of rights going to industry and consumers. Beyond these tangible advantages, it enable intangible assets, protected, to circulate between various partners within the rules and principles previously discussed and agreed, demystifying negative misgivings ahead of the challenges and needs of our country.

Notes

1. Available at: <http://www.wipo.int/ipstats/es/statistics/patents/patent_report_2007.html#P102_196> Access on: 08/05/2008.
2. Available at: http://www.institutoinovacao.com.br/downloads/Onde_esta_a_inovacao_no_Brasil-2007.pdf. Accessed in: 14/05/2008.
3. Índice de concentração setorial adotado por ETC Group (2001) e ETC Group (2005a) citado por Vieira Junior et al. (2007).
4. 2007 data.
5. Innovations in medicines (but not formulas), in general compounds or forms of obtaining extracts and diagnostic kits.

6. Of these granted patents, 21 refer to vaccines and antigen obtainment processes, 12 medicines, 6 diagnostic kits for diseases, 5 bioinsecticides, 3 in the area of equipment and 7 other various patents.

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