



INNOVATION IN BRAZIL

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Abstract:

Because Brazil has an important role in the worldwide economy, it is necessary to analyze its strengths and weaknesses. The purpose of this research is to expose some of limitations that keep Brazil from being known as a technologically innovative country. It will also show technologies and innovations that Brazil is embracing and is being successful with. Technology and innovation are critical factors for the country's development.

This study considers how Brazil is dealing with technological innovation, what Brazil has been doing in matter of technological innovation, and it will give a general overview of the projects and agencies that support and promote innovation in Brazil.

1.0 Introduction:

Globalization has increased the competitiveness of countries and the need for innovation is essential to expand participation in existing and new markets. Innovation is regarded as a strategic tool when considering a country's global position, and is key for a country to become more competitive, well known in the market place, and is a critical component to developing and increases its economy.

As countries make every effort to increase their international competitiveness, governments create stimulus policies to strengthen the innovative capacity of national companies. Since the beginning of this decade, with the return of industrial policies, innovation has assumed a role in the Brazilian government's program and policy agenda.

Global competition forces companies to perform at a higher level; to produce better products and services, businesses must invest in training and education programs that create more skilled employees.

The literature on competitiveness and innovation refers to this environment as "national systems of innovation." National systems of innovation are governed through incentives for innovation and are where interactions are facilitated by linguistic and cultural similarity, expanding the capacity to transmit tacit knowledge among individuals (1).

The purpose of this paper is to conduct a brief study of the main problems Brazil is facing in technological innovation, what are the weaknesses that deserves special attention, the challenges this country must overcome to be considered innovative, and show initiatives that are being successful in the country. The study will show some public and private companies that are considered innovative, and the actions the government has taken to sponsor R&D and innovation.

The paper will show that government, universities and companies are important players for investment in innovative activities. The governmental roles in Brazils case are to promote strong and explicit policies to promote the interaction between universities and companies. Thus, business strategies and government policies are an important element of analysis in reference to the development and challenges of the country's innovation policy.

2.0 Overview of Brazil:

Brazil is the biggest country in South America; occupying nearly half of South American territory and it is the fifth most populous country in the world. It has an estimated population of approximately 192,107,000 (2.83% of world population) people, and has a GDP around \$1.984 trillion dollars (2).

Although Brazil is a political and economic leader in Latin America, social and economic problems prevent the country from becoming an effective global power. Recently, the country has endeavored to strengthen ties with other South American countries, and engage in multilateral diplomacy through the United Nations and the Organization of American States. Brazil's current foreign policy is based on the country's position as a regional potential in Latin America, a leader among developing countries, and an emerging world power (2).

Brazil has large and developing agricultural, mining, manufacturing and service sectors, as well as a large labor pool. Brazilian exports are increasing, creating a new generation of tycoons. The country has been expanding its presence in international financial and commodities markets, and is regarded as a member of the group of four emerging economies called BRIC (Brazil, Russian, India and China). Brazil has today a well-developed organization of science and technology.

Basic research in Brazil is largely carried out in public universities and government controlled research centers and institutes. Some important research is done by private institutions, particularly in non-profit non-governmental organizations. Since the 1990s research has been slowly growing in the private universities and companies, as well. Accordingly, more than ninety percent of funding for basic research comes from governmental sources (2).

Applied research, technology and engineering are also largely carried out in the university and research centers system. Multinational companies have established large R&D&I centers in Brazil, starting with IBM, which had established an IBM Research Center in Brazil since the 1970s. One of the incentive factors for this, besides the relatively lower cost and high sophistication and skills of Brazilian technical, has been the called Informatics Law, which exempts from certain taxes up to five percent of the gross revenue of high technology manufacturing companies in the fields of telecommunications, computers, digital electronics, etc. The Law has attracted annually more than 15 billion dollars of investment in Brazilian R&D&I. Multinational companies have also discovered that some products and technologies designed and developed by Brazilians have a nice competitiveness and are appreciated by other countries, such as automobiles, aircraft, software, fiber optics, electronics, and so on (2).

3.0 Issues of Innovation in Brazil, Weakness:

In order to contextualize the present status of innovation in the Brazilian economy will be first shown statistics of how innovative are Brazilian companies. This statistic was published by PINTEC–Technological Innovation Research and made by IBGE, showing that 65 percent of Brazilian companies do not employ innovation, 31 percent constitute what is known as “imitator firms”. This signifies that of the more than 70 thousand firms surveyed in PINTEC, only 4 percent, or about 2,800 firms, have capitalized on R&D investments by creating new products or services (3).

For Brazil being a considerable country in matters of size and population, it is expected a better participation on the worldwide innovation. The problem with the development of Brazil and its ability to promote and subsidize technological innovation comes way before innovation was deemed important. It comes when Brazil was colony, where the exploration of raw materials and export were incontrollable; since that time Brazil was dependent on other better-industrialized nations.

This apparently overlooked but significant piece of history explains a little why the delay of Brazil to become an industrialized and innovative country. The country faces a lot of barriers and has difficulties to promote and support technological innovations. The biggest factors that hold Brazil back from being more innovative are the low level of primary education, and low supportive policies that promote innovation. Its innovation rate is really low compared to other countries, producing about 1,7% of international knowledge, versus the 8-9% produced by the United Kingdom, for example (4).

According to Aubert (2002) the investment in R&D is really low (0.8% of GDP). He stressed that another problem that holds investments in innovations is the vulnerability of the Brazilian economy to international financial crises, and related capital movements, what makes difficult the competitiveness and foreign investments in the country. Another problem that he indicated is the legal and regulatory environment that leaves much to be desired. The laws that exist are not properly enforced due to lack of means, and a weak judiciary system (5).

Sotero (2008) in a conference about innovation in Brazil highlighted the complexity of developing cohesive innovation policies as an issue that affect the development of innovation in the country. The investment in R&D&I is still low if compared to other countries, as shown in the figure 1 (6).

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are needed to see this picture.

Source: UNESCO

In addition, Cruz (2008) stressed that Brazil has an impressive ability to generate knowledge, but it fails to translate this knowledge into ideas, tangible products and services. He doesn't agree with the tendency in Brazil to focus innovation policies to benefit universities only, and continues saying that the universities are not the central players of innovative economy, but rather firms. Up until 1999, the government assumed that universities were adequate substitutes to pick up the slack in R&D not carried out by the private sector. As a result, universities dominated the country's public discourse on innovation-oriented policies, skewing policies in their favor (6). The figure 2 shows the investment in R&D (7).

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Source: <http://www.wilsoncenter.org/events/docs/Innovation%20Public%20Private%20Strategies%20English.pdf>

According to Cruz, despite the high level of scientific knowledge that Brazil owns, it lags far behind other countries if the subject is patent. Brazil has a considerable number of PhD graduates, but the patents registered in the U.S. Patent and Trade Office is not a considerable number if compared to other countries with less population and resources than Brazil. The problem is that Brazilian companies don't invest much money in R&D, and most of the scientists work for universities not for the private sector. For him, companies that invest more in R&D produce more patents and the more scientists employed in the private sectors the more patents the country registers.

Mauricio Mendonca (2008) says that the historical deficit of strong public policies is part of the reasons that Brazil is still behind OECD countries and others in matters of innovation. He emphasizes that the country's current economy is not conducive for large-scale innovation, this include high tax-rate and fees levied on businesses, poor labor relations, limited availability of financing, and the complexity of fiscal incentives provided by the Brazilian government (6).

While Brazil's innovation performance is improving – leading in deep-water oil exploration technology and production and use of renewable fuels – it is far from entering the ranks of top international innovators, complement Arbix (2008) (6).

According to the Masstricht Economic Research Institute on Innovation and Technology and the Joint Research Centre of the European Commission's global ranking for innovation (2007) points Brazil in as forty second out forty nine countries. One of the reasons for Brazilians low innovation score it the reduced volume of resources set aside for innovation activities, especially internal and external R&D. Brazilian companies invest about 0.77% of their net sales revenues on R&D, 0.34% on industrial projects and other technical preparations, 0.23% on introducing innovation in the market and only 0.09% on external R&D (7).

The most cited factor for the Brazilian problems to promote innovation are: legal instability, weak institutional framework, bureaucracy, high taxes, weak university-business interaction, deficiency and moroseness of the intellectual property system, and population low level of education.

4.0 Brazilian Innovation Strengths:

Brazil has several successful cases where direct state action contributed to the innovation process. Successful government action focused on addressing concrete market needs, especially international, partnership with private companies, aircraft, and biofuel. The three major companies that stand out in this field are Petrobras (Brazilian Petroleum Corporation), Fiocruz (Oswaldo Cruz Foundation), Embraer (Brazilian Aeronautics Company), and Embrapa (Brazil Agriculture Research Corporation).

4.1 Petrobras:

Petrobras (Brazilian Petroleum Corporation) is an integrated company that performs in oil and oil byproduct exploration, production, refining, marketing, and transportation, both in Brazil and abroad. Petrobras also is an energy company with a huge social responsibility and deeply concerned with environmental preservation. It has more than 100 production platforms, sixteen refineries, 30,000 kilometers of ducts and more than 6,000 gas stations (8).

Petrobras is internationally renowned as a reference in innovation and research in deep and ultra-deep water exploration and production. Petrobras assumed research in submarine robotics; in the fuel that powers car (the Podium gasoline technology was elaborated, tested, and approved in the Formula 1 racetracks); and in renewable energy, with the spotlight on biofuels; among others. Petrobras allocate one percent of our gross sales to finance new technologies. With this strategic position, it is among the companies that invest the most in research and

development in the world. It filed for 733 national and international patents – securing 216 of these patents to data (8).

4.2 Fiocruz:

Inaugurated on May 25, 1900 under the name of Federal Serotherapy Institute, Fiocruz was given the mission of fighting the great problems of public health in Brazil. Therefore, Fiocruz became a think tank concerned with the Brazilian reality and experimental medicine. Today the institution is responsible for a range of activities which include research development; highly-regarded hospital and ambulatory care services; production of vaccines, drugs, reagents, and diagnostic kits; education and training of human resources; information and communication in the area of health, science and technology; quality control of products and services, and the implementation of social programs. It has over 7,500 employees and health professionals with different levels of involvement, a workforce proud of being at the service of life (9).

4.3 Embraer:

Embraer (Brazilian Aeronautics Company, Inc.) was a public company, and in December 1994 it was privatized, it is one of the largest exporter Brazilian companies. It currently employs more than 16,946* people, 94,7% based in Brazil.

Embraer has become one of the largest aircraft manufacturers in the world by focusing on specific market segments with high growth potential in commercial, defense, and executive aviation. The company develops and adapts successful aircraft platforms and judiciously introduces new technology whenever it creates value by lowering acquisition price, reducing direct operating costs, or delivering higher reliability, comfort, and safety.

As a result, the aircraft produced by Embraer, provides excellent performance with day-in

and day-out reliability, while being economical to acquire and cost-effective to operate and maintain. Equally important, Embraer provides a superior product package, with comprehensive aircraft and after-sales support for parts, services, and technical assistance (10).

4.4 Embrapa:

Embrapa is a research institute linked to the Ministry of Agriculture, Livestock and Food Supply. The company researches agriculture, livestock and food in total collaboration with producer and population demand. Between 1990 and 2006, Embrapa filed for 229 patents and received 27 patents nationally. Besides the research conducted at its units, Embrapa also works in partnership with national and international universities, private companies and other research institutes (11).

Brazil is also being successful with incubators projects. They are generally linked to universities and funded by plural government and non-government sources. A considerable number of companies started their R&D in incubators and today they are respectful corporations. Financial support for incubators comes from programs such as the PNI (National Incubation Support Program) which is designed to support new incubator creation and the expansion of existing ones. The PNI program is supported by a coalition of government, industry and incubator associations, such as the Brazilian Ministry of Science and Technology, the CNPq (National Council for Scientific and Technological Development) and FINEP (Financing of Projects and Studies), SEBRAE (Brazilian Support Services for micro and small enterprises) and ANPROTEC (National Association of Incubators and Science Parks) (Chandra 2007).

An example of the success of incubators in Brazil is Bematech, created in 1990 by two graduate students with the support of the local incubator. The company started its business through miniprinters, Today counts with a considerable number of products. Bematech is now acting in several countries (USA, Germany, Taiwan, Australia, and Latin America countries).

Brazil pointed by Mirra (2008) has economy is in a position to create new cycles of long-term economic growth, what makes Brazil a target for foreign investments (6).

And some competitive advances according to Mendes (2007) are: strong local scientific base, sizeable base, sizeable industrial capacity, large domestic market, biodiversity, well-developed Telecom infrastructure, a substantial presence of multinational corporations, and significant purchasing power (14).

5.0 Support Organizations:

Over the last decades, Brazil has begun to give significant attention to innovation now that the country's leadership has realized innovation is key in a competitive globalize world. The country has allocated some organizations to help universities, research centers, and firms (private and public) to establish and support them in the process of technological innovation and R&D. The most important agencies engaged in this process are FINEP, SEBRAE, BNDS and CNPq.

5.1 FINEP:

The Research and Projects Financing, also knows as the Brazilian Innovation Agency, it has the purpose of financing scientific and technological research and graduate courses in Brazilian universities and research institutions, as well as in companies. It has the role to provide grants to non-profitable institutions (universities and research centers), and lend money to companies.

FINEPs mission is to encourage and finance innovation, and scientific and technological research in business, universities, institutes of technology, research centers, and other public or private institutions, mobilizing funds and combining the instruments employed in the country's economic and social development.

It provides grants to support every stage and dimension of the science and technological development cycle: basic research, applied research, product, service, and process innovation. It also supports incubation of high-tech firms (15).

5.2 SEBRAE:

The Brazilian Micro and Small Business Support Service is a private non-profit organization, supporting the development of small- sized business activity. It is a result of the union of both public and private sectors and the country's main fostering and research entities. It works in cooperation with the Brazilian Government, being the Ministry of Development, Industry and Trade part of the National Deliberative Council. Its mission is to promote the competitiveness and sustainable development of Micro and Small Business in Brazil (SMEs).

The strategic objectives are: to increase SMEs share in GDP, raising their participation in internal and external markets; to increase SMEs and entrepreneurs' participation in networks, broadening entrepreneurship and cooperation culture; to promote social inclusion via entrepreneurship; to focus on local productive systems in the development of small businesses.

Through its Innovation and Technology Unit, it facilitates technology access to SMEs, providing them with technical solutions, enhancing their innovative capacity and giving added value to their products and services.

SEBRAE works in cooperation with private sector and organizations for international cooperation in order to promote an entrepreneurial culture through seminars, courses, advisory,

communication and marketing, etc. It is not a financial institution and therefore it cannot grant credit. Nonetheless, it provides support so that the entrepreneur may have access to the needed resources: it seeks partnerships with banks, helps in the preparation of business plans, and makes available an endorsement fund, which warrants before creditor banks, up to 50% of companies credit operation (16).

5.3 BNDES:

The Brazilian Development Bank is a federal public company, related to the Ministry of Development, Industry and Foreign Trade (MDIC). Its goal is to offer long-term financing aimed at enhancing Brazil's development, and, therefore, improving the competitiveness of the Brazilian economy.

Since its establishment, on June 20th, 1952, the BNDES has financed large-scale industrial and infrastructure operations, as well playing a significant role in the support of investments in agriculture, trade and the service industry. The Bank also supports small and medium-sized private businesses, as well as social investments in education and health, family farming (agriculture), public transport, and basic sanitation.

The BNDES Credit Lines embrace long-term financing, at competitive interest rates, for the development of investment projects, the commercialization of machinery and equipment, and the growth of Brazilian exports (17).

5.4 CNPQ:

The National Council for Scientific and Technological Development (CNPq) is an agency linked to the Ministry of Science and Tecnologia (MCT), dedicated to the promotion of scientific and technological research and to the formation of human resources for research in the

country. Its history is directly linked to the scientific and technological development of Brazil (18).

6.0 Challenges in Brazilian Innovation:

Brazil is still way behind other nations when the context is innovation, as shown before. Some of the challenges the country needs to face are the policies to promote and support technological innovations, these policies need to be carefully thought out and reviewed frequently. After four seminars about innovation in Brazil, the presenters concluded that the most important public policies can be separated into five categories: (a) Industrial and sectors policies that aspire at promoting “productive activity, directed at development stages that are longer than pre-existing ones”; (b) Foreign trade policies, with import policies used to protect nascent industries, and export policies that help increase the competitiveness of national industry against international competitors; (c) Promotional and financing policies that enable long-term investments and the development of new technologies with R&D expenses, R& D investments have a high-degree of uncertainty and are normally left out of the private financing system’s scope. Thus, there is room for governments to work through non-reimbursable financing at low interest rates (without subsidies); (d) Policies for competition and regulation that aim at creating and maintaining a competitive economic environment in critical areas for innovation, including intellectual property policies; (e) Policies to support micro-, small- and mid- sized enterprises (SMEs) that have been able to play a significant role in innovative economies; And (f) education policies to train skilled labor and in the fields of science, technology and innovation that promote and stimulate the generation of knowledge in society by supporting academic and scientific research (7).

Another challenge to be faced is the technology transfer, not only internationally with big corporations and foreign governments, but also nationally between universities and research centers and Brazilian corporations. Brazilian universities have a substantial innovation capacity and are being supported by the old policies.

Intellectual Property (IP) is one more contest to get attention from the policymakers, according to Jorge Avila (2007), president of Brazil's National Institute for Industrial Property, Brazil gives little value to knowledge-based innovations and IP rights. And Hill (2007) complete, an effective IP system must balance between IP protection on one hand and dissemination of knowledge on the other, ensuring that consumers and future producers have access to advancements in innovation is as important as rewarding innovators with patent protections (19).

In 2004 was implemented the Innovation Law, these laws include: incentives for building and strengthening partnerships between universities, research centers and firms; incentives to increase university and research center participation in the innovation process; and incentives to promote innovation within companies. And in 2005 the government created a law to reinforce advances of the first law, the Good Law, this law created a series of fiscal incentives to promote corporate innovation-oriented physical and human capital investment in Brazil.

7.0 Conclusion:

Although Brazil has a considerable number of successful innovative companies, projects, and support agencies that promote support and implement innovation, there are still lots of work to be done, especially in matters of policy. It is important to create a strong and supportive policy that encourages and facilitates innovation needs to focus not only in universities, but also in the private sector, as well as review the policies already in existents.

Brazil has many significant cases of innovation to study. Ethanol is one example of when a productive partnership between government, research centers, universities, and private companies, have resulted in how the biofuel is being used today. Ethanol is not only mixed with gasoline, it is also by itself in bi-combustive cars (cars that runs with gasoline, ethanol or both in the same time) and is being massed produced throughout the country.

One of the ways to promote innovation in Brazil is to attract research and development centers from foreign companies. This is happening in India and other deviloping countries through tax incentives, and other government programs.

Brazil needs to give special attention to small and mid size companies, where innovative products are created, but later abandoned because of the absence of support in that field. How many good ideas are being left behind or forgotten because the creators do not know what to do, or where to go to make their ideas work? This is a question we may never have an answer for.

Because more than seventy percent of Brazilian scientist work in universities, entrepreneurship is essential to integrate that talent pool with private companies. It has been noted in other countries that the more scientists working in companies, the larger the number of patents registered, and innovation created.

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