The Higher Education System in Brazil and its Developmental Role

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Abstract

Universities contribution to development are being thought to go further than generate knowledge and training high qualified professionals, performing a third stream of activities in a proactive fashion, for economic and societal development.

The analysis of the Brazilian universities shows that they seem to evolve under a dual third mission configuration, in a divided fashion, taking apart societal and economic purposes, as the result of a socio-historical process. Convergence of those roles is show to be not only possible as well as desirable.

Universities strategy concerning their third role should also taking in account a proper balance between national government interests, in one side, and state and regional governments on the other side.

Key words: Universities; Development; Third mission

1. Introduction

Brazil has an area of 8,514,876,599 km2 (6.4% of the world surface area), an estimated population of 183,847,658 inhabitants (2.8% of the World population in 2005) and GDP equals to US$ 478 billions (2004) (1.9% of the World GDP).

The country has borders with most of the South America countries except Chile and Equator, as we can see in the map below:

Those big figures put Brazil asides with United States, Russia and China has the four only countries in the world with more than 4,000,000 km2, 100,000,000 inhabitants and US$400 billions GDP.

Behind those figures, however, we have a country with under-employment and a highly unequal income distribution, with large parts of its population being more or less excluded from the monetary market economy. Proximally, 22% of Brazilian population is under poverty line, with a GDP per capita of U$ 3.325 (2004). The country has a HDI of 0,775 (2002), being the 72nd position in the World. Brazil also presents an extremely uneven regional development. The income gap between the most and the least developed regions is enormous and still growing.

The Brazilian economy is characterized by large and well-developed agricultural, mining, manufacturing, and service sectors; Brazil's economy outweighs that of all other South American countries and is expanding its presence in world markets. From 2001-03 real wages fell and Brazil's economy grew, on average, only 2.2% per year (IPEA 2006).

The Brazilian economy composition by sector is 10% agriculture, 39.4% industry and 50.6% services. The country has a labor force of 90.41 million people and an unemployment rate around 9%. In agriculture, Brazilian products are mainly coffee, soybeans, wheat, rice, corn, sugarcane, cocoa, citrus, beef. And in industries, textiles, shoes, chemicals, cement, lumber, iron ore, tin, steel, aircraft, motor vehicles and parts, other machinery and equipment (World Fact Book 2006).

The country exports around $115.1 billion f.o.b. (2005) for US (20.8%), Argentina (7.5%), Netherlands (6.1%), China (5.6%), Germany (4.1%), and Mexico (4%). And also imports $78.02 billion f.o.b. (2005) from US (18.3%), Argentina (8.9%), Germany

(8.1%), China (5.9%), Nigeria (5.6%), and Japan (4.6%). The external debt of the country is $211.4 billion (2005) (World Fact Book 2006).

Innovation features

In 2000, the national expenditures in R&D in Brazil were in a level little higher than 1% of GDP, what represent more and less the same level of Spain (0,94%) and Portugal (0,8%), almost double of the Latin America countries average (0,6%), and much less than the average of OCDE countries (2,2%).

While industry is responsible for more than 63% in the expenditures in R&D in the OCDE countries, in Brazil this share is around 37%. As the R&D / GDP in the OCDE countries is 2,2%, the expenditures in R&D made by industrial sector is 1,39% of GDP (2,2% x 0,63) while in Brazil this share is 0,40% of GDP (1,07% x 0,37), 3,5 times less than the OCDE average.

When we analyze the government expenditures, there is not a big difference, in Brazil it is 0,67% of GDP while OCDE countries have an average of 0,81% (Parcerias estratégicas, N 20, 2005, Ronald Dauscha, 1469 p)

An example is the low number of researches working in the Brazilian industry. Using a classification called Scientist and Engineering (S&E) – that make R&D – Brito Cruz (2000) shows that, while in Brazil there are 80.000 S&E, almost 90% are linked to research organizations and the last 10% are linked to the 651 privet industries that make R&D (according to ANPEI survey). In the other hand, in USA, there are 1 million of S&E, 72% making R&D in privet industries, the same percentage as Japan. In other countries this percentage is also high: 70% in Germany, around 65% in France and England and 46% in Canada.

The main consequence of this low tax of S&E in the privet industry in Brazil is the difficult to convert knowledge into innovation.

The results of two Innovation surveys published by the Brazilian Agency for Geography and Statistics (PINTEC) may summarize this low dynamism (as presented in Cassiolato & Lundvall, 2005):

(i) Innovation rates (percentage of firms that introduced in the market new or improved products and/or process in the 3 year prior to the survey) are very low and declining for most sectors;
(ii) Innovation expenditures are concentrated on acquisition of capital goods not on pursuing R&D. More than 50% of the innovation expenditure of Brazilian manufacturing firms refers to the acquisition of tangibles (basically machinery). In most OECD countries this share is between 10% and 20%;
(iii) R&D expenditures by firms are not only small, but seems to be declining.

In short, the lack of dynamism can be captured by the statement that in the Brazilian case innovation activities of enterprises with innovation activities are strongly characterized by high expenditure in the acquisition of machinery and equipment, by low levels of expenditures and human resources involved in intramural R&D and by extremely low investments in extramural R&D.

Sum up, the Brazilian technical change system may be characterized as a technological learning process typical of imitating economies, in which technical change is restricted basically to the absorption and improvement of innovation generated overseas (Viotti, 2005).

Taken in consideration the Brazilian productivity, it remains stagnated since the year 1980. The average labor productivity of a Brazilian worker (measured in terms of a proportion of the north-American worker) came back to a relative position (in comparison to that of the leading industrial economy) similar to the one it occupied by 1960.

In fact, according to Viotti (2004), during the period (1980-2002):

(i) Brazilian productivity remained stagnated, although of the productivity of many of his concurrent (like Korea and Taiwan) continuous growing;
(ii) For instance, labor productivity of the industrial economy leader (United States) growth 40%;
(iii) One north-American worker produced around the same that three Brazilians in 1980; in 2002, it was necessary around four Brazilians to produce the same that one north-American

Looking at another indicator, the pattern of the recent Brazilian export performance, it shows (Viotti 2005) that:

(i) Low valued primary products represent 40% of the Brazilian exports in 2003, a proportion three times more than the world average of 2002, that was only 11%;

(ii) The category of products that more growth up world wide and favored more technological opportunity, the one of high technology intensity manufacturing, it is exactly the one that Brazil appears in the worse relative situation;

(iii)A little over 1/3 (30%) of the world exportations are of high tech intensive manufacturing , where in Brazil they represent a little over 1/8 (12%) of the total.

Both the low labor productivity of the Brazilian worker and the composition of Brazilian exportation are correlated to the low dynamism of the Brazilian technological innovation and learning process.

Higher education system & innovation

Innovation literature acknowledges the training of industrial scientist and engineering two major roles of the higher education system in innovation: the place where industrial scientists and engineering are trained as well as the source of research findings and techniques.

On the side of the human capital formation, certain features reveal a low profile in quality and in quality. In spite the total number of tertiary students expanded from 93,202 (1960) to 1,437,232 (1985), reaching 3,887,022 in 2003, the percentage of the age group 18-24 years of students enrolled in higher education didn't expanded , remaining around 10% (INEP 2004).

Most of the higher education institutions are private and for-profit (1.302 / 78,8%), only teaching institutions, many of them without good quality standards. As whole, the graduate system lacks proper evaluation criterions.

On the research side, however, the higher education system, represented mostly by their universities, are performing well. Brazil more than double its participation on the international scenario, went from 0,44%(1981), 0,7% (1994) to 1,6% of the total international publications in 2003. Nowadays Brazil graduates around 9,000 Ph.D. and 30,000 M.Sc. Next table shows the evolution of Brazil international publications compared to Latin America and to the World (INEP 2004).

Year	Brazil	Latin America	World	% of the Brazil in relation to the Latin America	% of the Brazil in relation to the world
1981	1.887	5.669	429.263	33,29	0,44
1982	2.183	6.190	439.911	35,27	0,50
1983	2.205	6.469	448.681	34,09	0,49
1984	2.269	6.481	448.675	35,01	0,51
1985	2.313	6.916	480.729	33,44	0,48
1986	2.481	7.430	498.474	33,39	0,50
1987	2.525	7.798	497.146	32,38	0,51
1988	2.770	8.047	517.284	34,42	0,54
1989	3.078	8.825	538.509	34,88	0,57
1990	3.552	9.614	553.749	36,95	0,64
1991	3.925	10.223	567.082	38,39	0,69
1992	4.643	11.659	605.519	39,82	0,77
1993	4.487	11.839	597.962	37,90	0,75
1994	4.838	12.871	632.988	37,59	0,76
1995	5.512	14.501	665.337	38,01	0,83
1996	6.053	15.946	674.061	37,96	0,90
1997	6.749	17.670	677.798	38,19	1,00
1998	7.919	19.336	702.844	40,95	1,13
1999	8.954	21.531	716.875	41,59	1,25
2000	9.524	22.615	714.966	42,11	1,33
2001	10.557	24.516	734.751	43,06	1,44
2002	11.285	25.743	730.229	43,84	1,55

Table 1 - Brazil: articles, from Latin America and world published in indexed international scientific periodicals in the Institute for Scientific Information (ISI), 1981-2002
Source: MCT (2006)

Even if the higher education system, as a whole, are not contributing satisfactory to the R&D manpower formation, it is doing well performing quality research and knowledge production at least at their universities.

We have science and technology development at the universities, but we don't have innovation at the industrial enterprises. For sure, that is a common paradox for many developing countries. More sounded and proper industrial and trade policies, a more friendly business ambient, more diffusion of an innovation culture, among others things, are necessary to provide the right context for industrial enterprises more adequately use the research findings and techniques delivered at the universities.

Under the innovation system approach, therefore, what is highlighted is the importance of knowledge spillovers from the educational and research activities in knowledge spaces.

However, our concern here is with the developmental role performed by the universities in animating economic and social development, as theorized by recent literature on triple helix model and on engaged university. (Gunasekara, 2004: Etzkovitz, Mello, 2004)

The main purpose of this paper is to analyze the developmental role of the Brazilian universities. We start with analyzing the building up of the Brazilian higher education system and their human capital formation performance. The postgraduate human capital formation and the research performance are presented at section 3. Trespassing the university system there is a dual third mission set of activities, one concerning with social inclusion and the other with the transfer of knowledge and technology for technical advance of the industry. Those dual third mission, their constitution and objectives, are analyzed at section 4, followed by the main conclusions.

2. Higher Education System & Human Capital Formation

The university is an institution of European medieval origin that has been universalized and successively transformed to perform new tasks in developed and developing countries. The first Spanish university in Latin America was founded in Santo Domingo, in 1538, soon after the conquest of the new world, well before the first universities were established in colonial America, such as Harvard, in 1636, to train religious and political leaders. In less than one century, 12 universities were founded by the Spanish, from the North to the South of the continent, the University of Cordoba, in 1613 (Buarque 2003).

Higher education in Brazil only started at the first half of the XIX century, with the foundation of isolated undergraduate professional schools. Only at the first half of the XX century Brazilian universities started to be implemented, after the proclamation of the Republic (1889).

At the beginning, during the 1920 decade, universities started to be created simply by a process of incorporation of isolated undergraduate professional schools existing in a given state, to be administratively management by the respective state, and jointly funded by the union and the state. Six public state universities, typically agglomeration of isolated professional schools, were created during that decade.

One first major attempt to give a legal framework for the Higher Education system in Brazil happens at 1931, at the beginning of the Vargas's dictatorship (1930-1945), just after the creation of the Ministry of Education. A 1931 Education Law was established by which University was considered the preferential format for higher education institutions.

However, not only new universities continuous to be created under the principle of conglomeration of isolated schools but most of the higher education institutions being created were of the non-university type, mainly specialized schools and institutes.

By the 1931 Law, the purposes of higher education included "stimulate scientific research in all domains", HEIs in Brazil remained for a long time essentially offering

undergraduate courses vocationally or professionally oriented. Scientific research and high level training were to be institutionalized only at the 1960 decade.

Since 1964, orchestrate by the Brazilian military regime (1964-1984), a series of legal decrees legislating on higher education matters have been established, ending with a consolidated 1968 Law, which is considered to be the second major attempt to provide a legal framework for the Brazilian higher education system. According to the 1968 Law text, the aim was to improve the higher educational system, increasing its flexibility, efficiency, modernity, for the human resources formation of higher level for the country development.

Under the 1968 Law, higher educational institutions may offer (i) undergraduate courses; (ii) postgraduate courses *stricto sensu* (master and doctorate degrees) and (iii) postgraduate courses *latu sensu* (specialization certificate). Research activities were attached to the postgraduate programs stricto sensu, aimed to advance knowledge and to provide research training for the postgraduate students (learning by doing research).

Higher education institutions in Brazil, by the 1968 Law, can be classified by publics or privates. Publics institutions can be sub classified as (i) Federals – supported and managed by the Federal Government; (ii) States – supported and managed by State Governments; (iii) Municipals – supported and managed by Municipal Governments.

Private institutions, by other hand, can be sub classified as non-profit or pro-profit ones. Finally, the non-profit private institutions can be (i) Communitarians; (ii) Confessionals – religious orientation; and (iii) Philanthropists.

As far as the academic organization, by the same 1968 Law, higher education institutions can be classified as Universities, Specialized Universities and Universities Centers, Centers for Technological Education, Isolated Schools, Extensive Schools and Institutes of Higher Education.

An overview picture of Brazil Higher Education Institutions can be figure out from INEP (2004) Educational Census. There are 1859 Higher Education Institutions (HEIs), distributed along the following categories:

HEIs type	Universities Number Totals	Others HEI Number Totals	Summing up Partial Totals
Federal	44	39	83
States	31	34	65
Municipals	4	55	59
Total Publics	79	128	207
Pro-profit	26	1,276	1,302
Non-profit	58	292	356
Total Privates	84	1,568	1,652
Total HEI	**163**	**1,696**	**1,895**

Table 2 - Higher Education Institutions in Brazil , 2003
Source: INEP (2004) Census

Human capital formation performance

The main educational concern of the federal government at the higher education system always has been with the undergraduate system, with incorporate all HEIs. This system nowadays presents many distortions as revealed by recent governmental reports mainly by the Brazilian Minister of Education, in a context were a new Higher Education Reform Law is under discussion by the Federal Government.

A first concern is with the expansion rate of the system. The total number of undergraduate students went from 93,202 (1960) to 1,437,232 (1985), reaching 3,887,022 in 2003; the number of universities growth from 39 (1964) to 163 in 2003, a growth of 64%, and, during the last years, the total number of HEI growth from 900 (1997) to 1,859 (2003), a growth of 106% (INEP 2004).

This expansion, however, were favoring atomization, with more than 44% HEI with less than 500 students, and with the high predominance of specialized schools and institutes.

In addition, the expansion was lower than desirable, since the number of undergraduate students enrolled at HEIs in 2003 (3,887,022) comprised only 11% of their age group (18-25 years), the same proportion achieved in 1985. Government plan is to increase that proportion to 30% up to the year of 2010, what looks very unlike, take in account today figures (Project of law of high education reform, 2005)

The more distinguished phenomenon is the fast expansion of the private institutions during the last decades, what puts Brazil at the leadership in Latin America in number of institutions and of students enrolled in private institutions. The percentage of private HEI related to the total number of HEI growth from 74,4% (1994) to 88,9% in 2003, were the public sector, already minority (25,6%), was reduced to 11,1%.

Number of HEI (%)	1994	1998	2002	2003
Public	25.6	21.5	11.9	11.1
Private	74.4	78.5	88.5	88.9

Table 3 - Evolution of the distribution of Public and Private HEI
Source: INEP (2004) Census

Data from the enrollment of tertiary students confirm the uncontestable hegemony of the private sector. From a total of 1,661,034 students enrolled in undergraduate courses in 1994, 41.64% were at public institutions and 58.4% at private ones. From 1994 to 2003 there was one exponential growth in the enrolled numbers in private institutions. Data from INEP 2004 Census reveal that private institutions hold 70.8% of the 3,887,771 students enrolled, the public sector remained with 29.2%.

Year	Total	Public %	Private %
1994	1.661.034	690.450 (41,6)	970.584 (58,4)
1998	2.125.958	804.729 (37,9)	1.321.229 (62,1)
2002	3.482.069	1.053.811 (30,3)	2.428.258 (69,7)
2003	3.887.771	1.137.119 (29,2)	2.750.652 (70,8)

Table 4 - Enrollment at undergraduate courses
Source: INEP (2004) Census

The evolution of the Brazilian Higher Education system was not without inequalities, varying from regional, social and racial terms, based on the enrolment of undergraduate students in HEIs. Before going on those inequalities we should mention that equality has been recently achieved in terms of gender, with female enrolment (2,193,246) even a little bit higher than male enrolment (1,693,776), for the year 2003. However, gender inequality still prevails in engineering and technology areas, with a male share around 80%.

Inequalities are also present in relation to HEIs distribution along the five Brazilian regions, reflecting, by the way, the same pattern of economic inequalities (Cunha 2004). We may see in the table bellow the disproportional concentration of HEIs and of enrolment of undergraduate students in the Brazilian regions

Region/Indicators	Population (%)	Number of HEIs (%)	Tertiary enrolment (%)
North	14.048.422 (7,6)	101 (5,4)	230.227 (5,9)
Northeast	51.661.192 (28,1)	304 (16,4)	624.692 (16,1)
South	27.209.453 (14,8)	306 (16,4)	745.164 (19,2)
Southeast	78.319.102 (42,6)	938 (50,5)	1.918.033 (49,3)
Middle west	12.685.488 (6,9)	201 (10,8)	368.906 (9,5)
Total Brazil	183.847.658 (100)	1.859 (100)	3.887.022 (100)

Table 5 - Regional inequalities
Source: INEP (2004) Census

For racial inequalities, Brazilian government is trying to implement some affirmative actions, especially at the Federal Universities, such as special number of places reserved for black and mixed people. This initiative is based on a research made by MEC, Brazilian Ministry of Education, that shows that at the Brazilian universities the share of

black, white and mixed people is different that at the society. The next table shows the result of MEC research in the Brazilian universities:

	White People	Black People	Mixed People
Universities	72,9%	3,6%	20,5%
Society	52,0%	5,9%	41,0%

Table 6 - Share of white, black and mixed people in the Brazilian society and HEIs
Source: Project of law of high education reform (2005)

So what Brazilian government is trying to implement by law (waiting for approbation at the Brazilian congress) is a cote of 50% for black and mixed people in each course of the federal universities. If this law is approved, those institutions will have ten years to implement the cote.

One last point is concerned to the undergraduate students enrolment related to the areas of knowledge. A disturbing picture appears; nearly 70% of the students are enrolled at undergraduate courses in Human and Social sciences and only 11% in Engineering and Technologies, data for the year 2003. Brazil The whole picture is provided bellow

Areas	Human & Social Sciences	Life Science	Exact Sciences	Agriculture Science	Engineering & Technology	Others
% enrolment	69%	13%	4%	2%	11%	1%

Table 7 - Areas of Knowledge enrolment distribution
Source: Cavalcante (2005)

3. Higher Education System & Postgraduate Human Capital Formation and Research

Until the 1950 decade, nearly all of the HEIs were involved only with the human capital formation (teaching oriented HEIs) at the undergraduate level. That reflects partially the low level of qualified workforce demanded by the productive sector at that epoch.

From the beginning of the sixties the Brazilian scenario was shacked with the appearance of a left-centrist government (1961). For one side social movements put forward demands for structural reforms – agrarian reform, banking reform, juridical reform and university reform. From the other side there were government efforts for an economic growth sustained by an industrial sector more technologically advanced.

It was a time of creative effervescence, although a very turbulent one. On the higher education side, one outstanding mark was the creation of the University of Brasilia, a

federal university, inspired by the most eminent scholar in education affairs at that time, Anisio Teixeira.

It was created under a modern university conception, more akin with a research-oriented institution, with a new administrative organization based on centers, departments – the locus for disciplinary knowledge advances - and courses, a new faculty career, full time and exclusive dedication requirements and so on. The bases for the modern Brazilian university were launched.

The Brazilian National Bank for Economic Development (BNDE), at that time, in a effort to stimulate technological advance in the industrial sector, launched one funding program to support firms technological activities, the so called FUNTEC (fund for technological development). Nearly no demands arose from the industrial firms. BNDE's directors realized that the non-attendance was due mainly to the lack of high trained engineering, and so they decide turn their funding program (FUNTEC) to support the creation of postgraduate engineering programs research-based (Etzkovitz, Mello 2004).

That's how the Post Graduated School of Engineering (COPPE) was made viable and established at the University Federal of Rio de Janeiro, heavily supported by FUNTEC, to graduate high qualified engineering on a learning process through research - learning by doing research, incorporating University of Brasilia new conceptions, like a faculty careers, promotion by merit, full time professors and so on. Funds were given for COPPE set up an outstanding structure, covering full time professors/researchers wages, machines and equipments for the laboratories, library, and computational infrastructure. The bases for the modern postgraduate and research system were launched, rooted in a university-industry context, with government support.

At the same time, a deeper reform of the Brazilian university was being advocated by the National Students Union, inspired by the so called "*Manifiesto de Cordoba*", launched by the Cordoba Student Union, in 1918, directed to all free man of South America, denouncing the colonialist cultural dominance at the South America universities and proclaiming the necessity of a university being autonomous, self-governed by professors, students and ex-students, in a tripartite equality, open admission criteria for professors, open careers for professors, curriculum flexibility, etc.

Moreover, for the Brazilian Students Union, the university should have a neat compromise with the popular classes, should have an extension mission linked to the popular needs, helping their emancipation. The debate for a debate about the extension mission of the university was launched.

This fertile period of ideas and initiatives was halted by a military takeover. The military regime comes under the double compromise Security & Development. On the security axe, social movement was put under severe vigilance; leaders were arrested, civil rights suspended. Brazilian universities, mainly the public ones, were damaged by the forced retirement of hundred of professors who were exiled or expulsed. At the University of

Brasilia 225 professors were expulsed and many students had the same fate. National Students Union has been closed and their leaders arrested (Buarque 2004: Morel 1979).

By other hand, on the development axe, the proposal was ambitious, to transform Brazil in a great power, to develop technological capability and autonomy in strategic areas, to modernize the industrial park as a whole. National development programs associated with Scientific and Technological programs has been launched.

The supplier of highly trained scientists and engineering as well as the generation and diffusion of knowledge and technology becomes a priority for that development model. The organizational structure of the University of Brasilia was the base for the (re)structuring of the Brazilian university system, based for the first time on an effort to nationally integrate the university system.

The previous steps towards the institutionalization of the research at universities associated with the creation of postgraduate programs were accelerated; there was a widely available financial resources and support for those initiatives. It included training young students on a massive level by providing scholarships to study abroad in masters and doctorate programs in foreign universities.

The 1968 Law of the Higher Education System, commented earlier, provided the legal framework for the implementation of this integrated university system, contemplating also the integration of teaching and research.

From the 1970s one big research and postgraduate system at Brazilian universities were put in place and becomes a very successful enterprise, as attested by the figures bellow.

Research and postgraduate performance

A large higher degree system was set-up, which awarded in 2003 some 8,000 PhD's and 28,000 Master's degrees. Table 8 below shows the evolution of that system over the period 1987-2003

	1987	1989	1991	1993	1995	1997	1999	2001	2003
Ph.D. degrees	868	1.047	1.489	1.803	2.528	3.620	4.853	6.040	8.094
MsC degrees	3.647	4.727	6.811	7.609	9.265	11.922	15.380	20.032	27.630
Ph.D. new students	1.786	2.416	3.509	4.132	5.331	6.199	7.903	9.101	11.343
MsC new students	9.440	11.432	12.768	13.633	17.746	17.570	23.837	28.074	35.305

Table 8 - Expansion of Brazilian Pos Graduation System 1987 – 2003
Source: CAPES (2004)

Brazil has some 15 000 research groups distributed within 268 institutions. Almost 90% of all research groups are under the responsibility of universities, isolated colleges and research centers. Table 9 illustrates the trend in these numbers over the past 10 years, during which, for example, there has been a remarkable growth in the number of

institutions and research groups.

	1993	1995	1997	2000	2002
Institutions	99	158	181	224	268
Groups	4.404	7.271	8.632	11.760	15.158
Researchers (C)	21.541	26.799	34.040	48.781	56.891
Ph. D. holders (D)	10.994	14.308	18.724	27.662	33.947
(D)/(C) in %	51,04	53,39	55,01	56,71	59,67

Table 9 - Number of institutions, research groups, researchers and Ph.D. holders, Brazil, 1993, 1995, 1997, 2000, 2002
Source: CNPq, 2004, www.cnpq.br

Nowadays there are 196 institutions that offer 1.819 programs of pos graduation (MsC / PhD) in Brazil, this institutions can be classified by the level of the offered degree as we can see in the table below.

Only MsC	1 - 3 PhD	4 - 9 PhD	10 - 25 PhD	More than 25 PhD
101	56	14	14	11

Table 10 - Number of institutions that offer pos graduation per level of degree
Source: INEP (2004)

In the case of the pos graduation, the share between areas is little bit different than in the under graduation programs. Some areas, like engineering for example, maintain the same share (11%), but in the case of human science, the share is much lower (31%). We can see then whole picture in the table below.

Areas	Human & Social Sciences	Life Science	Exact Sciences	Agriculture Science	Engineering & Technology	Others
% enrolment	31	30	12	11	11	5

Table 11 - Pos graduation: Areas of knowledge enrolment distribution
Source: INEP (2004)

Other interesting feature of the Brazilian pos graduation system is the biggest regional concentration.

Brazil %	Southeast %	South %	Northeast %	Middle west %	North %
1.819 (100)	1.021 (57)	353 (19)	277 (15)	111 (6)	57 (3)

Table 12 - Pos graduation: Regional inequalities
Source: INEP (2004)

While we consider biggest level of degree the Regional inequalities increases considerably, for example, if we take only the pos graduation programs with PhD degree,

southeast region have a share of 65%, and if we take only the programs that have the highest degree in the government annual evaluation, southeast region has a share of 81%.

4. Universities & Dual Third Mission

The socio-historical development of the Brazilian universities, schematized at the last section, reveals a dual configuration of university third mission. Both stimulated by governmental agencies and both generating differentiated internal organization structures at the universities to favor the accomplishment of those respective third missions.

One first type of third mission is the one with a social inclusion perspective. It reflects a tendency to push university more closely to social movement demands, trying to recover the original ideas behind the 1960s student unions aspirations.

As commented before, with the military regime, the debates around the extension mission of the Brazilian universities were halted for security reasons. Nevertheless, a more paternalistic view of the extension mission was incorporated in the 1968 Education Reform Law, where it appears defined in terms of courses and especial services to be offered to the community.

Later on, with the return to democracy, and on the civil society mobilization for a new Constitution, in 1987/1988, the discussion of the extension mission of the universities arose again leading to the inclusion at the new Constitution, under the high education heading, the interconnectivity between the teaching, research and extension missions.

The proper concept of extension transmuted from the traditional community service to a compromise with social inclusion. Under this new conception, as postulated by the National Forum of Vice-Presidency of Federal Universities, the university extension is an educative, cultural and scientific process that articulate teaching and research in a no dissociable way, and makes viable the transforming relation between university and society.

Universities are in process of adjusting themselves to fulfill this other third mission role, now more concerned with social development, with social inclusion.

The newness of this recent transmutation may be seen from the fact that at the last survey processed by the Minister of Education, the extension activities performed at the higher education institutions were still classified under community service rubrics, such that medical care, law assistance, radio broadcasting and so on.

Anyhow, those records testimony the magnitude of the community service delivered by the higher education institutions, a resume of which are transposed bellow.

	Number	%
Universities	175.268.971	97.9
Others HEIs	3.787.809	2.1
Total	179.056.780	100.0

Table 13 - Number of attendances in HEI Health Units in 2003
Source: INEP (2004)

	Number	%
Universities	346.629	73.4
Others HEIs	125.704	26.6
Total	472.333	100.0

Table 14 - Number of attendances in law assistance by HEI in 2003
Source: INEP (2004)

Nowadays, however, the vice-presidency of extension at the universities are dealing with the new concept of extension and there is an on-going process, a tentative to make the academic community sensible, to configure their research and teaching activities akin to that social inclusion mission. However, still nowadays, the vice-presidency of extension is still processing a large set of activities varying from events, community services up to special programs for social inclusion. In some universities, activities like technology incubators, incubators of popular cooperatives and even a division of intellectual property and transfer of technology are under the responsibility of the vice-presidency of extension.

However, the general trend is towards extension with the social inclusion purposes, without any commitment with the market.

By other hand, at the vice-presidency of postgraduate and extension , another type of third mission was persuade, relate to the transfer of knowledge and technology to the industry.

To deal with the activities of technology services management, contracts negotiation, contracts elaboration, patenting, technology commercialization, human resources capacity training and technological diffusion, Technological Transfer Offices has been created at the universities. A recent survey showed 30 TTOs in operation in Brazilian universities.(Lahorgue, Ritter, Mello, 2005).

Knowledge and technology transfer also goes by high qualified professional graduated at the institution, which are subject to a process of learning by doing research, taking with them the tacit and codified knowledge acquired.

Knowledge and technology also can be transferred by spin-offs or start-ups firms. Usually incubators are the structure utilized for that purpose. Firm formation process may

involve others mechanisms and activities, like entrepreneurial teaching, junior enterprises, pre-incubation process etc.

At the universities, the incubation process started to be introduced in their institutional development strategies according to the following tendencies (Lahorgue 2004):

- Introduction of entrepreneurship teaching in all levels (undergraduate, graduate);
- Prospecting of technologies that can be developed by spin-offs firms of the university research, in the incubators and in the science parks;
- Utilization of the incubator's management expertise to enhance the services and management consultancy to local SMEs.

There are 107 technological incubators and 10 science parks in operation in Brazil (Etzkowitz,Mello,Almeida, 2005) nearly all linked and installed at universities.

5. Conclusions

Universities have long been recognized as providers of basic scientific knowledge for industrial innovation through their research and related activities. In a traditional view (Neoclassical economy theory), the role of knowledge and of institutions involved in the creation of knowledge was seen as exogenous although not unimportant to the production system. The development and diffusion of knowledge was viewed in linear terms – the science push model – in the sense that knowledge was created outside the productive system, either in universities or the laboratory of large firms and then "pushed" out to industry for applied development and adoption.

The emergence of the national systems of innovation approach changes this conceptualization of the role of universities in economic production. Innovation systems were envisioned as dynamic complexes of interaction among industry, government, business support institutions, knowledge creation institutions and labor, capital and product markets, for the creation, diffusion and adoption of knowledge. (Gunasekara,2004 c)

The locus of action in knowledge creation, diffusion and adoption are re-focused from an exogenous position (to the firm) toward a clear endogenous location within firms, networks of firms and networks of firms and other organizations such as universities. Industry is acknowledged as the primary institutional sphere shaping economic development, with State and University institutional spheres regarding as co-adjuvant.

The role of the universities under the innovation system approach is focused of the knowledge spillovers resulting from their educational and research activities.

Nowadays it is increasingly recognized that important roles as enablers, even leaders, of regional and social development, which has been incorporated under the notion of a third role for the universities, besides the teaching and research ones.

New approaches has been developed conceptualizing this third role, including the triple helix model of university, industry, government relations – prescribing one generative role -and the emerging literature on university engagement – prescribing one broad developmental role. (Etzkowitz, 2002a, 2002b, Etzkowitz and Leydesdorff 2000, 1999, 1997; Leydesdorff and Etzkowitz 1998; Holland 2001, 1999; Chatterton and Goddard 2000; Goddard and Chatterton 1999; Gunasekara, 2004a, 2004b, 2004c; Howard 2005)

The developmental proposed role for the universities includes the generative one, through academic entrepreneurial activities, but submits it to a broader focus, with the universities adapting their core functions of teaching and research, as well as community service, to address state and regional needs.

In analyzing the Brazilian universities third mission role, we recognized two different third missions role, one as an extension of the research mission and the other characterized by the extension of the teaching and research mission towards social inclusion.

Although the first one, extension of the research mission towards technical advance in industry, it may be positioned like a generative role in nature, the other third mission type doesn't fulfill the developmental role ideal, by the exclusion of any entrepreneurial activity.

This separation appears to prevent a full engagement of the university, in all social and economic dimensions, with the surrounding state and region.

One step towards that convergence may be seen by the creation of technology transfer complex units at some Brazilian universities (Universidade Federal do Rio Grande do Sul, for instance), mostly linked to the presidency of the university, which centralizes the management of not only activities concerning university-industry interaction, but also some other activities concerning university-society interactions (like the incubators of popular cooperatives and regional development projects) (Lahorgue, Ritter, Mello, 2005).

The exercise of a developmental role presumes an active engagement of the university with its community, that is, a strong link to their local and regional economies. In fact, municipal, state and regional governments are taking a close interest and involvement in the contribution of the universities for the regional economic and societal development.

It may follows, as commented by Howard,2005, that national, state and regional issues will have to be carefully balanced with some universities having a national or international focus (more akin to a generative role)whilst others will develop strong state and regional ties (more akin to a developmental role).

That's appears to be perhaps a major challenge for the Brazilian university system, how to balance it take in consideration state, regional and national interests and the diversity of socio-economic roles.

The Road Ahead

The results presented in this paper are partial results of an on-going research project "The Developmental Role of the Brazilian Universities", being developed as part of an international comparative research project UniDev "Developing Universities – The Evolving Role of Academic Institutions in Economic Growth", coordinated by the Research Policy Institute, University of Lund, Sweden. The author of this paper is the Brazilian team leader.

This paper is at the moment being revised and discussed by the members of the Brazilian team as the basis for the preparation of the theoretical and methodological framework for the case study, a deeper study about the developmental role of the Federal University of Rio de Janeiro, the bigger Brazilian university.

That document will be presented and discussed in a seminar to be held in next April, with the presence of researchers and policy makers from the institutional spheres university, industry and government.

The complete road map for the project may be seen bellow:

Brazilian project Road Map	
Activities	**time**
1º General meeting	Lund, June 2005
South Africa meeting	November 2005
Havana meeting	February 2006
National Workshop	April 2006
Case study Federal University of Rio de Janeiro	1st phase May - August 2006 2nd phase October 2006 - June 2007
1st Version Master Document	September 2006
2nd General Meeting	September / October 2006
2nd Version Master Document	August 2007
Final Document	November 2007
Final Workshop	Decemberr 2007

6. References

Brito Cruz, C. (2000). A Universidade, a Empresa e a Pesquisa que o País Precisa. Parcerias estratégicas – N 8. Available at http://www.mct.gov.br/cee/revista/Parcerias8/britocruz.PDF at 31/01/2006.

Buarque, C. (2003). The University at a crossroad. Paper presented at the World Conference on High Education + 5 at UNESCO. Paris, 23-25 June.

CAPES (2004). Relatório Final da Avaliação Trienal da Pós-graduação - Período Avaliado: 2001-2003. Available at www.capes.gov.br at 31/01/2006.

Cassiolato, J,; Lundvall, B.A. (2005). The Brics project – first draft of position paper. Delivered at South Africa Globelics meeting.

Cavalcante, C. (2005) "Educação e inovação: o papel e o desafio das engenharias na promoção do desenvolvimento industrial, científico e tecnológico". Número 21 - Brasília, DF

Chatterton, P & Goddard, J 2000, 'The Response of Higher Education Institutions to Regional Needs', European Journal of Education, vol. 35, no. 4, pp. 475-96.

Cunha, L.A. (2004) Desenvolvimento desigual e combinado no ensino superior. Estado e Mercado – Revista Educação e Sociedade, Campinas, V 25, No88, pp795-817

Dauscha, R. (2005). O Retrato da P&D das Empresas no Brasil. Parcerias estratégicas, N 20, pp. 1463 – 1484.

Etzkowitz, H (2002a). Incubation of incubators: innovation as a triple helix of university-industry-government networks. Science and Public Policy, vol. 29, no. 2, pp. 115-28.

---- (2002b). MIT and the Rise of Entrepreneurial Science, Routledge, London.

Etzkowitz, H & Leydesdorff, L (1997). Introduction: Universities in the Global Knowledge Economy. in H Etzkowitz & L Leydesdorff (eds), Universities and the Global Knowledge Economy: a Triple Helix of University-Industry-Government Relations, Pinter, London and Washington, pp. 1-8.

---- (1999). The Future Location of Research and Technology Transfer. Journal of Technology Transfer, vol. 24, pp. 111-23.

---- (2000). The dynamics of innovation: from national systems and "mode 2" to a triple helix of university-industry-government relations. Research Policy, vol. 29, no. 2-3, pp. 109-23.

Etzkowitz,H.; Mello,J.M.C.; Alemida,M. (2005) Towards “meta innovation”in Brazil. The evolution of the incubator and the emergence of a triple helix. Research Policy, 34, pp 411-424

Etzkowitz, H.; Mello, J.M.C. (2004). The rise of a triple helix culture. Innovation in a Brazilian economic and social development. International Journal of Technology Management and Sustainable Development. Vol 2, No 3, pp 159-171

Favero, M.L.A. (2004) Autonomia e Poder na universidade:impasses e desafios. Perspectiva, V 22, No1, pp197-226

--- (2000). Universidade e Poder: análise crítica e fundamentos históricos. Brasília: Editora Plano

Goddard, J & Chatterton, P (1999). Regional Development Agencies and the knowledge economy: harnessing the potential of universities. Environment and Planning C Government and Policy, vol. 17, pp. 685-99.

Gunasekara, C. (2004a) The third role of Australian universities in Human Capital Formation. Journal of Higher Education Policy and Management. Vol 26, No 3,pp 329-343

-----, (2004b) Universities and communities: A case study of change in management of a university. Prometheus, Vol 22 No 2, pp201-211

-------,(2004c). The regional role of universities in technology transfer and economic development. Bristish Academy of Management Conference, St. Andrews, Scotland.

Holland, BA (1999). From Murky to Meaningful: The Role of Mission in Institutional Change. in RG Bringle, R Games & EA Malloy (eds), Colleges and Universities as Citizens, Allyn and Bacon, Boston, pp. 48-73.

---- (2001) Toward a definition and characterization of the engaged university. Metropolitan Universities, vol. 2, no. 3, pp. 20-9.

Howard, J. (2005). The emerging business of knowledge transfer: from diffusion to engagement in the delivery of economic outcomes from publicly funded research. In Triplex Helix 5 proceedings.

Lahorgue, M.A. (2004b). La gestion des relations avec l´industrie: le cas des universities brésiliennes. Paper presented at the IMHE Conférence Générale 2004 - Choix et Responsabilités: Enseignement Supérieur et Société du Savoir.

Lahorgue, M.A.; Ritter, E. Mello,J.M.C. (2005). Economic Development Mission in Brazilian Universities. In Triplex Helix 5 proceedings.

Leydesdorff, L & Etzkowitz, H (1998). The Triple Helix as a model for innovation studies. Science and Public Policy, vol. 25, no. 3, pp. 195-203.

Morel, R. (1979). Ciência e Estado: a política científica no Brasil. São Paulo: T.A. Queiroz.

Viotti, E. (2004). Technological Learning Systems, Competitiveness and Development. Discussion Text Nº 1057, Brasília, IPEA.

Viotti, E., Baessa, A. e Koeller, P. (2005). Perfil da Inovação na Indústria Brasileira – Uma Comparação Internacional. cap. 16 em Salerno, M. e De Negri, João (eds.), Inovação, padrões tecnológicos e desempenho das firmas industriais brasileiras, Brasília, IPEA, 2005, pp. 653-687.

Web Sites

National Council of Science and Technology - Conselho Nacional de Desenvolvimento Científico Tecnológico (CNPq) – www.cnpq.br - at 20-31/01/06

National Institute of Studies and Researches in Education - Instituto Nacional de Estudos e Pesquisas Educacionais (INEP) - www.inep.gov.br - at 20-31/01/06

Science & Technology Ministry - Ministério da Ciência e Tecnologia (MCT) – www.mct.gov.br at 20-31/01/06

World Fact Book - http://www.cia.gov/cia/publications/factbook/index.html at 20-31/01/06