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The Brazilian National Graduate Program, Past, Present and Future: a short review

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ABSTRACT This article aims at presenting the current structure of the Brazilian National Graduate Program. It describes the development of the courses from their starting point in the Thirties focusing on the last six decades. It demonstrates that after the country set up the two national agencies to foster science and technology, CAPES and CNPq, investments in this area have increased tremendously. As a result the number of courses and the numbers of Master's and doctoral enrollments have soared. The current Brazilian National Graduate Program is presented in full. Moreover, while scientific production has also increased, technological development and innovation are still lacking pace. The role played by state agencies for research development is emphasized as an important additional way of complementing the federal agencies. Despite the advancement made, the article points out important challenges that are still to be faced to put Brazil in a better position in international scientific rankings.

Historical Background

In contrast with the USA and other Latin American countries, Brazil turned to higher education very late. The first higher education college was created only in 1808, when Dom João VI, King of Portugal, arrived in Brazil escaping from the French and created the Escola de Cirurgia da Bahia (Surgery School of Bahia), which later became the Medical School – FAMED (Faculdade de Medicina). In 1811, the seeds of the future engineering schools in our country were sown: the Royal Military Academy, in Rio de Janeiro. In 1827, finally, the Law School of Recife and the Law School of São Paulo were established by Dom Pedro I – both independent schools, as were the medical and engineering schools. The universities, led by the state of São Paulo and the federal system of universities, were created only in the twentieth century: first, the University of Rio de Janeiro in 1920, later renamed the Federal University of Rio de Janeiro, and the University of São Paulo, the biggest and best ranked of all, a decade later, in 1934.

Within this context, a general teaching prevailed in the universities and isolated schools of the first period, in which the level of undergraduate studies was very basic, leading to a Bachelor degree which lacked technical content. Regarding graduate studies, which were non-existent until the early decades of the twentieth century, the possibility of their implementation only appeared after the third decade in Brazil. The legal instrument was the Statute of the Brazilian Universities of 1931, proposed by the federal government. The major propositions fixed the general criteria of the organization of the universities, showing a concern with research (Decree no. 19.851 of 1931). By the same token, the Statute of the University of Brazil (former University of Rio de Janeiro), of 1946, included in the articles the principles of graduate studies (Almeida & Borges, 2007), opening the doors for the first experiences. However, it was only after the 1960s, during the military regime,

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that several higher education institutions started a national movement to implement Master's degree programs in different areas of knowledge. As shown by researchers, this movement was the result of the creation, in the 1950s, of the federal agencies of financial support connected to the Ministry of Science, Technology and Innovation (MCTI) and the Ministry of Education (MEC): the National Research Council (Conselho Nacional de Desenvolvimento Científico e Tecnológico, CNPq) focused, on research, and the Program (Coordination) for Personnel of Higher Education (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES), focused on graduate programs.

Of the two, CAPES is deserving of special comment in its double function of financing the graduate system and of evaluating the activities of all the graduate programs in the country, with its ranking system, now worldly recognized. Having recently completed 60 years of existence, it was created by the Decree no 29.741 of 11 July 1951, which instituted a Commission to promote the 'National Campaign of Improvement of the Personnel of Higher Education Level', with the following objectives: 1. to ensure the existence of specialized personnel in sufficient quantity and quality to support the requirements of the public and private entrepreneurship necessary for the social and economic development of the country, and 2. offer to people who are highly capable but short of means, access to all opportunities of improvements.

Since then CAPES endeavors to fulfill its role in the implementation and consolidation of the Master's and doctorate programs in all the states of Brazil, investing in the courses and the training of qualified personnel and subsidizing the MEC in the formulation of public policies for graduate studies. Its basic activities cover procedures such as: evaluation of graduate courses (Master's and doctorate), access to the dissemination of scientific production (outcomes), investment in the training of high-level human resources in the country and abroad, and the promotion of international scientific cooperation. More recently, in 2007, it took on the task of taking care of the quality of basic education (6 to 17 years old), acting in primary degree teaching, which presents such historical deficiencies that are problematic enough to block the expansion of higher education, graduate studies included (Sá Barreto & Domingues, 2012).

Along with the action of CAPES and the legal instruments mentioned above, the Report no. 977/65 of the Federal Council of Education, by Counsellor Newton Sucupira, constitutes an important aspect of the historical process of graduate studies in Brazil, and was focused at graduate level, defining the kinds of courses that should be offered in the country (Relatório Sucupira, 1977). Soon after its announcement, the Report became an authoritative document for the sector, a basic reference for the structure and functioning of Brazilian courses, allowing the organization of the process of authorization and certification with a minimum standard of quality. After more than 30 years, it is not an exaggeration to say that the Sucupira Report, with all the inevitable and necessary adjustments, is still a reference for the system of graduate programs today.

Beyond these regulatory standards and legal instruments for the graduate system in Brazil, essential for the creation of programs and courses, the system was consolidated and developed within the more ample grounds of University Reform, introduced by law in 1968 (Law no 5.540 of 1968), by an act of the military regime. In order to modernize the university as the basis of development plan, graduate studies were stimulated and received the necessary recognition to face their challenge of growth. Strategically, by the end of the military regime, the editions of the National Plan for Graduate Studies (PNPG) have constituted, starting in 1975, another essential element in the construction and development of the national system of graduate studies, culminating in its last edition with the PNPG 2011-2020 (2011).

To conclude this brief introduction, presented with the aim of familiarizing overseas readers with the Brazilian higher education system, it is necessary to give some data about undergraduate teaching, which can influence in one way or another the following stage of the system (INEP, 2010). As in the USA, and unlike in France and Germany, undergraduate courses in Brazil are offered by public and private institutions. In 2010, according to the National Institute of Education Studies and Research (INEP), there were 5,449,120 students enrolled in undergraduate courses, 1,461,696 in the public sector and 3,987,424 in the private sector. Of the total number, 829,286 students completed their courses, 178,407 in the public sector and 650,879 in the private. In this same year 3,120,192 openings were offered (445,337 public and 2,674,855 private) for a total of 6,698,902 candidates and 1,590,212 of them entered by a selection examination. In other words, a total of 1,529,980 openings were left unfilled, an impressive number. However, the reasons for

such a distortion (inflated openings by the private universities, low income of the population, among others) are not the focus of this article. Still regarding this aspect, the total of new students entering the undergraduate system, including other processes besides the selection examination, was 1,801,901; 435,710 in public institutions and 1,366,191 in private. Finally, there were 83,443 academics teaching at undergraduate level, 45,292 with a doctorate degree, 24,069 with a Master's degree, and the remaining with an undergraduate degree.

All in all, this set of data shows the basis of the graduate system, which still presents the potential to expand, however with important setbacks that challenge the government (federal and state), especially in the final period of high school, as mentioned before. The number of students enrolled in high school, which lasts for three years, is 8,357,675 (INEP, 2010). However, the quantity of higher education students is far from reaching one-third of this number, owing to drop-out and retention, and is estimated as 1,909,630 students according to official figures (Nunes, 2012).

Graduate Programs in 2010

The overseas reader, in his or her attempt to understand the Brazilian educational system, its setbacks and its potentiality, should consider that the country opted to implement a dual public/private system in all levels of education, with the private sector representing 75% of the provision in higher education. However, if we compare undergraduate and graduate courses, it is clear that graduate education is almost monopolized by the public sector, led by the state universities of São Paulo and by the federal university system. It should be added that the model adopted by the private sector is focused on an enterprise model, except for the Catholic universities and communities colleges. The public sector, on the contrary, seems to oscillate between two models or tracks: 1. the model of the Humboldtian research university, adopted by some of the federal universities and the three universities of the state of São Paulo (around 39, according to the scholar João Steiner (2007), that follow the criteria of the Carnegie Classification); 2. a group of heterogeneous institutions that do not fit into the American models of colleges or communities colleges, led by an impressive number of university centers classified as universities, but which should in fact be designated by another concept/name, such as institute or center for higher education.

Finally, the reader should not lose sight of the notorious fact that, despite its late implementation about 50 years ago, the Brazilian graduate system is not as big as those of the USA or China but it is one of the most solid in the Western world, with great achievements already attained and a significant potential for expansion, depending on the actions and willingness of the government. However, there are serious distortions which are a motive of concern in the system, as will be shown later in this article.

First of all, focusing on its important achievements, in recent decades Brazilian graduate courses have shown impressive growth, represented by an increase in the number of courses and students and an increase in research production and its international participation (PNPG, 2011). On the one hand, the number of courses offered evolved with the following rate of growth in the period between 1976-2009: 5% per year in the number of Master's programs and 6.6% in the doctorate programs. On the other hand, in the period between 2004-09 the growth was even bigger, when there was a yearly growth of 6.9% in the number of Master's courses and 7.6% in the doctorate programs. Another important point is that the growth in numbers of enrolled, new and graduated students at the doctorate level, in the period 1987-2009, was impressive: the number of enrolled students grew from 8366 to 57,923; new students evolved from 1796 to 14,155; and the number of graduated students, which was 864, reached 11,368. Moreover, the increase in enrolled students in this same period was more than 600%, that of new students was about 700% and that of graduated students reached 1300%. Finally, the rate of graduated students per enrolled students evolved from approximately 10% in 1987 to 20% in 2009.

Similarly, the evolution of Master's degree students in the period 1987-2009 is the following: an increase of 300% for the number of enrolled students, 485% for new students and 970% for students who have graduated.

Although still considered low when compared with the USA and the major countries of Europe, the number of graduated students in the Master's and doctorate programs per 100,000

inhabitants grew significantly in the same period: in 2006 these rates for Master's and doctorates was 17.39 and 5.05, respectively, while in 2009 the values reached 20.08 for Master's and 5.92 for doctorates.

This performance of the graduate-level education is followed by an increase in research. Both go together (hand in hand), as everybody says, and if the relation between teaching and research is not compulsory at the undergraduate level, the same cannot be said about the graduate level. Today the locus par excellence of the Humboldtian research university is in Europe and the USA. So, witnessing the effects of the close alliance between teaching and research in Brazilian graduate education, the outcomes of graduate programs in the past decade have increased more than the growth of the Brazilian population. In 2000, 6.14 articles per 100,000 inhabitants were published, while in 2009 this number reached 17.93. There are other data giving evidence of the increase in scientific production, by comparing the Brazilian numbers with those of other countries. So, in 2009, both ISI and Scopus databases put Brazil in 13th position in terms of indexed articles. According to the Scopus database, between the years 1981 and 2008, the Brazilian growth rate of production of scientific articles is higher than the world average.

However, if in graduate education and research the results are impressive, other important aspects of scientific and technological production are of great concern today, as in the case of patents. The ranking of innovation published by The Global Innovation Index/Insead, located in the USA, shows Switzerland at the top, the USA in seventh, China in 29th and Brazil in 47th positions. In the case of patents, Brazil appears in the 2009 WIPO **IN FULL** ranking in 25th position, with 480 deposits, while the USA are in first position (45,790), followed by Japan in second (29,827), Germany in third (16,736), South Korea in fourth (8066) and China in fifth (7946). In historical terms, taking the last 40 years as a reference, Brazil is losing position to the Asian emergents: Taiwan (1975), South Korea (1983), China (1986), Singapore (1996), India (1998) and Malaysia (2007).

The Proposed Scenario for Graduate Studies: the Brazilian National Graduate Program – PNPG 2011-2020

This section presents the main aspects and propositions of PNPG 2011-2020 (2011), taking into account the study of Sá Barreto and Domingues (2012). Several propositions are sequential in relation to the previous fifth Plan (2005-10) such as the reduction in regional asymmetries, the emphasis on the social inclusion and the search for internationalization. Beyond important revisions in the evaluation procedures of graduate programs, strategic actions are proposed, such as the creation of a National Agenda of Research, a partnership between CNPq, the Federal Innovation Agency (FINEP) and the State Agencies for Research Development (FAPs), adapting to this country a similar initiative in Australia. According to the PNPG, the creation of the National Agenda of Research, bearing in mind that the goal is to emphasize the applied sciences and engineering, will consider other aspects of the basic sciences and other areas of knowledge, in order to achieve the necessary balance of the two groups. Among these, the areas in the frontiers of knowledge, such as complexity, astrophysics, theory of evolution, neuroscience and others, have been considered. It was also proposed to adopt a systemic approach to the diagnosis, directions and propositions, leading towards an articulation and entanglement of the subjects/themes of research, instead of their separation and fragmentation.

In its main lines of propositions, the PNPG 2011-2020 is based on five directions/axes:

> 1- the expansion of the National System of Graduate Studies (NSGS), the priority of quality, the breaking down of endogeny and attention to the reduction of asymmetries (regional and of areas of research); 2- the creation of a new national agenda of research and its association with graduate education; 3- the improvement of the evaluation and its expansion to other sectors of Science, Technology and Innovation (ST&I); 4- the multi- and inter-disciplinary procedures amongst the main characteristics of graduate education and important themes of research; 5- support for basic education and other levels and types of teaching, especially in high school. (PNPG, 2011, p. 15, our translation)

The five directions/axes, in their process of deployment or implementation, lead to a set of general guidelines which, according to the Plan,

> should be observed, implemented by specific induced actions, and defined by governments and the community:
>
> – support for the creation of research and graduate education networks, with national and international partnerships, in the frontiers of knowledge, aiming at the discovery of the new and the original;
>
> – emphasis on the environmental issues, associated with the search for sustainable development and the use of clean technologies;
>
> – assurance of support to the inertial growth of the NSGS, but favoring the use of significant parts of the agencies' budget to implement innovative policies;
>
> – focusing on the different programs aiming at development, economy, health and education in Brazil, for the cultural characteristics of the public;
>
> – attention to the current generation of children and youth, particularly in the areas of health and education in actions directed at basic and superior education including graduate studies, because of the performance of the Brazilian economy in the next decades will depend on this generation, in a context of rapid growth, in absolute and relative terms, and of a significant increase in the elderly population. (PNPG, 2011, p. 294, our translation)

A set of specific guidelines has also been announced. In total, 10 actions are considered strategic, split into specific actions and objectives. The summary and key words of each one of these specific guidelines are presented here:

> 1. solid expansion of the NSGS in the next decade;
> 2. improvement of the evaluation system;
> 3. emphasis on multi- and inter-disciplinary procedures;
> 4. reduction or elimination of asymmetries;
> 5. increasing the programs and support of CAPES to basic education;
> 6. increasing the university–industry–government partnership, to achieve the culture of innovation and entrepreneurship;
> 7. emphasis on the qualification of human resources to respond to the demands of the public sector and strategic national programs;
> 8. increase international cooperation, to eliminate endogeny;
> 9. expansion of financial support and improvement of legal instruments for research and graduate studies;
> 10. creation within CAPES of an office, connected to the Presidency of the agency, to follow up and evaluate the newly created programs proposed by PNPG 2005-2010 and PNPG 2011-2020 (PNPG, 2011, pp. 294-305).

Last but not least, the Plan highlights the need to formulate specific strategies aiming at the creation of new paradigms for the development of the system. In other words, it gives preference to the creation of strategic programs which will be drafted and proposed by the agencies, based on suggestions of the universities, research institutes, state government offices, the business sector and other sectors directly involved with the national development. This implies the establishment of inductive actions that will consider new resource funds and redirecting the budget of the agencies. However, in order to be successful, and even before being implemented, such initiatives should start by the acknowledgment, by state governments, of the importance of the qualification of human resources and basic education to graduate education, to ensure the development of the state and of the region.

Facing the huge programmatic challenges and the complex financing institutional engineering required, the PNPG 2011-2020 proposes a strong articulation between federal support agencies (CAPES, CNPq and FINEP) with the FAPs and the State Science and Technology Secretaries (from here on, SCT), as well as with the industrial sector. However, since the universities are autonomous, they should be convinced of the importance and even of the urgency of such a project, knowing their role in the process of generating knowledge and of its transformation into technology. To conclude, in the pursuit of the partnership between the universities, the governments and the industrial sector, the aim is the implementation of the triple helix model in

Brazil, which has been the driving force of the knowledge society in other parts of the world (Sá Barreto & Domingues, 2012).

Graduate Financial Support from the Federal and State Agencies

The basic pillar of scientific and technological development in any society rests on the qualifications of researchers and scientists. In Brazil, scholarships which have the objective of motivating and fostering the qualifications of masters and doctors, neutralizing the distortions of the social distribution of wealth and favoring the meritocracy, are part of the academic menu and are considered fundamental to increasing the scientific-technological outcomes and consequently to the success of the National Graduate Program. On top of the practical benefits, the scholarship has the role of training scientists, as in the case of the initiation in science at undergraduate level – a Brazilian contribution whose academic results are well recognized – which has the function of awakening young people's vocation for science, which could be the first step to a career as a scientist. In addition to these scholarships, the NSGS has also other types of scholarships aimed at researchers, supported by CNPq and other agencies. Along with scholarships, with their diversity, there are still calls for projects, with their priorities, whose role in the establishment of groups of academic excellence and in firmly fixing research in the institutions has great importance. This article will not take this aspect into consideration, however, since its complexity would require a special analysis which would necessitate a very long discussion.

Returning to financial support of graduate studies, the following data present the situation of the qualification of Masters and doctors in a recent time interval, showing an impressive growth in the number of scholarships offered to students of graduate programs.

Scholarships by CAPES

CAPES deals mainly with the scholarships which are given to the graduate programs during the Brazilian academic year, from March to February of the following year. These grants represent the goals to be attained in the period and reflect the flux of the graduate students. Therefore, the use of the scholarships conceded to the institutions varies according to the academic calendar of each program and the periods of major student enrollment.

Transforming these considerations into numbers, we have the following picture: while in 1995 19,428 graduate scholarships were granted in the country, of which 12,040 for Master's degrees and 7388 for doctorates, in 2010, 33,060 Master's degree scholarships were granted and 21,769 for doctorate degrees, representing an increase of 174.6% and 194.6%, respectively, in comparison with 1995. Regarding the evolution of concessions of scholarships in the country from 1995 to 2010, in percentage figures, the annual growth average for Master's degrees is shown to be 11.64% and for doctorates, 12.97%. Projecting into the immediate future, taking into consideration the actions in course and planned, it is believed that the system will continue to grow with similar rates.

There are still other aspects of the program and types of existing scholarships which must be considered important to understanding the change of context and the change of governmental policies. In the early years of this century, the concession of post-doctorate scholarships, recently introduced, were for those people studying abroad. In 2002, CAPES introduced a program to support institutional projects with the participation of young doctors (PRODOC) in order for them to complete their qualifications, and this represented 400 scholars. With the participation of CNPq, another program was created by CAPES, the National Plan of Post-Doctorate, and this modality received a big increase, becoming a great basis of support.

Summing up these actions and their achievements, the programs of international scholarships have allowed CAPES to complement its work in the qualification of high-level personnel in areas in which the NSGS is not fully consolidated. Furthermore, these programs allow opportunities for cooperation with international institutions, aiming at responding to the international policy of the Brazilian government, as well as stimulating qualifications in strategic areas and allowing Brazilian scientists to play a role on the international scene.

On this topic, it is important to point out that the growth in the international scholarship programs was motivated mainly by the modalities of the 'sandwich' doctorate and the post-doctorate, which are given priority by CAPES for qualification and training in foreign universities. In contrast, the full-time doctorate abroad has registered a decline owing to the current policy of maintaining this modality only for the topics of research which are considered high priority in each area of knowledge. This situation, over the years, has generated distortion in the NSGS, leading to the rigidity of programs as well as the isolation of faculty members, many times resulting in a total endogeny in their studies. Concerned about this distortion, the PNPG 2011-2020 indicates the need to change this policy, suggesting an increase in full-time doctorates abroad. At the same time, without a real coordination of actions, the current federal administration put forward the program 'Science Without Frontiers', fixing a goal to send 100,000 undergraduate and graduate students abroad, in various modalities of training, including full-time doctorates, counting on the participation of private sector investment for this. No doubt this is an ambitious and important initiative, yet arbitrary and somewhat dangerous, which may have high costs for the system insofar as it excludes, for example, the social sciences and humanities. Again, this topic is left out of this article owing to its extensive nature and complexity, which would require a special and long analysis which is not in the scope of the present article.

Scholarships by CNPq

As mentioned before, CNPq is another funding federal agency whose actions have a big impact on the NSGS. This is the case for scholarships. In 2008, 9005 Master's degree scholarships and 7005 doctorate scholarships were implemented by CNPq. In 2010, the numbers were 11,253 for Master's and 8852 for doctorates. In the near future it is expected that these numbers will increase even more.

Similarly to CAPES, during this period CNPq made strong investments in highly qualified human resources in all areas of research, when the agency implemented, besides the scholarship program in the country, the program for foreign countries, which also worked successfully with about 3000 students doing their doctorates and Master's degrees in foreign universities. However, later this changed owing to the federal government policy of prioritizing the National Graduate Program, with the exception of a few areas considered strategic. Moreover, the CNPq programs were not as large as the CAPES ones.

Scholarships by FAPs

An important example of contribution to graduate programs is the focus given to scholarships by the FAPs of the different states of the Federation, whose capacity for investment has increased.

This is the case for Master's and doctorate scholarships. In 2007, the FAPs implemented 3968 scholarships for Master's and 2409 for doctorate programs. In 2010, the numbers nearly doubled. Similarly to CAPES and CNPq, an increase in these numbers is expected in the years to come.

Another important aspect of the FAPs, and also of the SCT, is that they are spread all over the country and therefore more prepared to provide scholarships and to fund researchers. This model of the state supporting agencies of ST&I has, consequently, a privileged situation leading to important consequences in public policy in the areas of education, science, technology and innovation.

Hence, added to the national coverage, the FAPs and SCT have knowledge of the needs and the reality of the different regions in Brazil. This ensures the optimization of federal funding according to the situation in each region. It is one of the strategies that help to reduce the asymmetries identified by the PNPG 2011-2020.

Today, the FAPs have within their regions and states a role similar to that played by CNPq, CAPES and FINEP at the federal level.

Number of Graduate Students With and Without Scholarships

According to CAPES, in March 2010 the public institutions, excluding the private institutions, had in their graduate programs, Master's and doctorate programs, a total of 154,059 students. Out of this total, 53% (49,849) of the students on the Master's degree programs and 49% (29,467) of those following the doctorate programs did not have a scholarship. Therefore, there is a need to increase the efforts of the state and federal agencies to support a higher number of students in order to guarantee the conclusion of their academic work, and to attract new students to the graduate programs.

If nothing is done to solve this problem, with just half of students in full-time courses, the completion deadline for theses will barely be honoured, with a permanent risk of increasing the dropout rate, owing to the pressure of getting a job to survive.

This situation is even worse if we consider that the population of students in all levels of education in the public system is very low, less than 1% of the Brazilian population of 190 million inhabitants. So, it is not only a question of expansion, but there is a need and urgency for the growth of the graduate public system to support the growth of the country and to eliminate inequalities in order to have a proactive role in ST&I amongst other nations. To consider this question we will discuss next the financing of education.

Investment in Graduate Education

It is important to study the composition of the participation of the public and private sector in the total investment in research and development – R&D. Table I presents important data showing that public investment in Brazil, although it is at a reasonable level, has to increase substantially. However, the private investment must increase much more so that we may have a similar situation to that in the developed countries. In the case of the private sector, this growth needs to be to the order of four times bigger than the current situation. This diagnostic has already been accepted by the entrepreneurs who, in 2009, created the Industrial Movement for Innovation.

Country	Private	Public	Total
Japan	2.50	0.94	3.44
Korea	2.10	0.70	2.80
USA	1.80	0.88	2.68
Brazil	0.54	0.59	1.13

Table I. Private and public investments in ST&I (percentage of GDP).
Source: MCTI-ABDI.

Not considering the financial investment in education, which no doubt is impressive with a major contribution from the private sector, the support for ST&I in Brazil is mainly carried out by the federal public sector. However, in recent years the participation of the state public sector has increased. Disregarding undergraduate education, the investment in graduate education comes almost exclusively from the public sector.

All things considered, following international standards, the MCTI analyses the investment in ST&I and R&D covering the three sectors: public (national and state), private and higher education – in the first case, following the recommendations of UNESCO; in the second, according to the *Frascati Manual* (Organisation for Economic Co-operation and Development, 2002).

Thus, the programmatic functional analysis, which serves as a historical reference for the acquisition of data up to the year 2000, had distinguished as a sub-program the investment in graduate studies. Since then the programmatic criterion has been substituted by the institutional view. According to the MCTI, in the year 2000, 1.3% of GDP was allocated to ST&I and out of this total 0.27% was allocated to graduate programs.

Effectively, in 2000, the federal government allocated 0.49% of GDP in activities of ST&I, while the states of the Federation allocated 0.24% and the industrial sector 0.56%. With regard to graduate education, as has been pointed out, the support was due mostly from the public sector. The consequences of this analysis indicate that two challenges are still to be overcome. The first

states the need to increase the investments in the area of ST&I, which has always required a bigger share of GDP; the second, focusing on the limitation of the public sector, is to motivate the industrial sector to invest more in its personnel, which is a condition for increasing international competition. It is worth mentioning that the activities of training and capacity-building of human resources with a formal degree are considered more as an ST&I, academic-type activity, than as an industrial-type, R&D activity.

Source	Amount (US$ x 1000)	% related to ST&I	% GDP
Federal	2516.5	11.68	0.17
State	1800.2	8.36	0.12
Private	354.2	1.64	0.02
Total	4671.0	21.68	0.31

Table II. Funding of the National Graduate Program (percentage of GDP – 2008).
Source: MCTI (2014).

Comparing the data of the budgets at all levels of investment accomplished in 2008, a significant increase can be seen since then (see Table II), where it can be observed that the federal government increased its contribution, while the private sector and the states maintained their investment at the same levels. The larger participation of ST&I in GDP is impressive, especially if it is considered that GDP practically tripled in the period, increasing from US$600 billion in 2000 to US$1.5 trillion in 2008.

Returning to the preceding aspect, data which can be considered inconsistent appear when the investment in graduate studies is compared relative to that in ST&I by sector, to the total of ST&I, to GDP and to the investments in R&D in relation to the same parameters. As can be seen in Table III, the level of investment in graduate studies is apparently bigger regarding R&D, including the private sector. In fact, according to the preceding analysis and data, there is no increase and the higher rate is explained by the withdrawal of the activities which are typical of ST&I and do not apply to R&D.

It should be emphasized that these analyses are based on the implemented budgets and they may differ from the following data shown next, which do not necessarily refer to the implemented budgets and do not incorporate the salaries of faculty staff and researchers, or assets; they refer only to the scholarship for and support of graduate activities. Therefore, within this perspective, these are direct investments in graduate studies. As discussed, according to the MCTI, in 2008 1.43% of GDP (to the order of US$1.5 trillion) was invested in ST&I, which originated from US$8 billion from federal sources, US$3.5 billion from the state sources, or a total of US$11.5 billion from the public sector and US$10 billion from the private sector.

Sector	S&T		R&D	
	Total (R$1,000)	% for GP	Total (R$1,000)	% for GP
Federal	7987.3	11.68	6034.6	15.36
State	3569.0	8.36	2805.9	10.99
Private	9988.8	1.64	7543.7	2.16

RS is the Brazilian currency.

Table III. Investments in the National Graduate Program as part of S&T and R&D – 2008.
Source: MCTI (2013).

One of the important elements of the participation of the federation states through their FAPs and SCT is the real possibility of increasing the resources to support graduate studies. A recent survey from CONFAP (National Council of the FAPs) indicates that, in recent years, the budget implemented by the FAPs has been about US$1 billion/year (CONFAP, 2012).

This number puts the budget of all FAPs a level above CNPq, which in 2010 had a budget of US$700 million, showing that there was in the last decade a substantial increase in financial support from the FAPs.

Concluding Remarks

Brazil is a continental country, known for its cultural diversity and the enormous potential of its natural resources, as well as its large population, amongst the largest in the world. Until recently, owing to the huge contrasts in its regions and unequal distribution of social wealth, the country was called by critics, the majority of whom were Brazilian, 'Berlindia' – rich as Belgium and poor as India. Today, this situation has changed and this name does not apply any longer, not only because of the European crisis, but also because of the progressive enrichment of India, which, like Brazil, is part of BRICS, showing that the social-economic reality is truly dynamic and that the situation of the countries can change from one moment to the next.

It is, therefore, based on this historical and comparative context that the situation of Brazilian graduate education, from the view of its legacy, its achievements and its perspectives, can be described and evaluated. As shown, the country arrived to higher education very late compared with other countries, including in Latin America, and arrived much later to post-graduate studies, having established the federal system about 40 years ago. The process of implementation of Brazilian graduate studies is still in course, led by the public universities, especially the federal universities and those of the state of São Paulo, and it is far from finished, still demonstrating a lot of potential to grow. The accomplishments of this sector of education, after decades of continuous effort, when faculty staff and researchers have qualified in Europe and the USA, could not have been more impressive or have had a greater impact.

In terms of teaching, there was the breaking down of the old paradigm of the traditional university, composed of dilettantes, practitioners and self-made scholars, concentrating on teaching activities and without any compromise with research – and why research for its own sake if the main task of the university is to prepare personnel for the governments and professionals for society, whose role models are at hand, in the schools of engineering, medicine and law?

Today, the situation has changed. There has been feedback from graduate studies in the activities of undergraduate level education, teaching and research have started moving together and progressively the Humboldtian ideal has been consolidated in the public universities. Nevertheless, its effective realization is far from being achieved and the road to it is open.

Regarding research, the impact was even greater, with the country ranked 13th for the total of papers published in indexed journals with international impact, according to the recent data of the Scopus and ISI. databases No doubt, this position and the positive increase of scientific production observed over the past decade reveal that the country has rapidly risen in the international rankings, but that there is a significant gap still to be filled if this ranking is compared with the position of the country as the sixth largest economy in the world and the fifth largest in population. So, a lot has to be done in this area, if the goal is to transform the potential of the country into reality.

From an agricultural country, dependent on and exporter of commodities, Brazil since the 1930s has paved the way to industrialization, based on the mechanism of substitution of importation, and so it reached the modern era, although unable to overcome the condition of a periphery country. As mentioned before, today this situation has changed and, with the help of its universities and research institutes, the country has become an important reference in high technology in important sectors of the economy, in which Petrobras (oil in very deep water) and Embrapa (agricultural technology, especially in the cerrado [1] area) stand out.

However, if these technological and scientific achievements are extraordinary, in other sectors Brazil remains in an indigent status in innovation technology and in the transformation of science and technology into innovation. When considering the conceded patents, the country has lost, in recent years, position in relation to various Asian nations. On the other hand, the country is richer and a great number of poor and excluded people suddenly emerged from class E into classes C and D, discovering the benefits of the consumer society and increasing the internal market. Yet, our Gini index, the one which measures social inequalities, is improving, according to IPEA (Institute of Applied Economics Research, linked to Brazil's Federal Administration), has moved from 0.53 in 2002 to 0.49 in 2009, on a scale from 0 to 1 (the nearer it is to 1, the higher is the inequality). However, according to the IPEA head officer, in a statement published by the newspaper *O Estado de São Paulo*, although the decrease in inequality has been significant, 'a rate above 0.4 would still represent a very bad income distribution. There is a trend towards a fall, but

we are still far from reaching a rate comparable with more advanced countries' (Agência Estado, 2002).

There is still another index, the Human Development Index (HDI), created by Amartya Sen and collaborators, which shows that the Brazilian situation is not good at all, having reached the index 0.718 in 2011, which corresponds to 84th position out of 187 countries, although not too bad if compared with other BRICS countries: Russia (66th), China (101th), South Africa (123th) and India (134th), but far from the USA (4th), Germany (9th) and Japan (12th) (Fernandes, & Garcia, et al, 2013; see Table III, p. 11, where the authors show the comparison above.).

And to make matters worse, if it is true that the Gini index and the HDI show how social inequality depends on education and give evidence of how the educational gap has the power to decide the future of various generations, it condemns people to the harshest of indigence. Associated with it is the problem of basic education, as has been mentioned: historically, only 50% of the students coming out of elementary school reach senior high school and only 50% of those students who begin later come to graduate, revealing the existence of a structural distortion of greater significance.

As if this were not enough, higher education adds its own distortion due to the fact that the private universities, after offering more and more positions for incoming students, generated in 2010 more than 1.5 million unoccupied positions.

It is noticeable that the legacies and setbacks are of a great number and efforts that have to be made by the Brazilian people to overcome them are equally as challenging, requiring heavy investments in education. In our favor, it is possible to count with the so-called demographic bonus, allowing the population growth to stabilize at comfortable rates. Such a point is really important and to it is associated the window of opportunity that was open to our economy, which has grown very much in the past decade and is well diversified, however jeopardized by the de-industrialization in course and the focus only on financing rather than investment as the major activity.

It is in this context that higher education and, even more so, the graduate system will be able to respond to the demands of society and help it to deal with the enormous challenges, depending on the goodwill of the politicians and society itself.

Note

[1] The 'cerrado' is a form of scrubland and the second largest biome in Brazil. According to the *Oxford Dictionary*, scrubland is 'an area of dry land covered with small bushes and trees'.

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