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The Graduate Foundations of Research in Brazil

Elizabeth Balbachevsky* and Simon Schwartzman**

Abstract. This paper presents some of the most relevant institutional traits of Brazilian graduate education, explores some facets of its history and examines the link between graduate education and the research enterprise in the Brazilian experience. For the last of these, it uses data produced by a survey on the Brazilian academic profession from 2007, which formed part of the international project the “Changing Academic Profession” (CAP project). The paper shows that contrary to international experience, in the Brazilian case, graduate education and not research came first. One of the factors explaining the success of Brazilian higher education in building a strong research profile is hidden in its success in building a strong tier of graduate education. Our analysis shows how graduate education in Brazil emerged in the 1970s as a by-product of the consensus built between political leaders, policy makers and the domestic leaders in the sciences around a project that puts science as a core policy for promoting the country’s economic development and independence. As this project grew, it created the necessary conditions for research to become institutionalized inside the small number of Brazilian universities that had succeeded in developing a robust tier of graduate education.

Keywords: Brazil, higher education, graduate education, graduate education evaluation, research organization, research community

Introduction

In 1993 Burton Clark published a major work analyzing the connections between research organization and graduate studies, especially the doctorate, in mature systems of higher education. In this work, Clark argues that it is this connection that makes the difference between this higher level of education, and the other kinds of training offered by all higher education systems around the world. As posed by Clark,

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Any country can have advanced higher education that has little or no relation to research activity and training Conversely, countries can have much research activity and even research training accomplished away from locales of advanced education. What we explore are conditions of the third possibility, the unity option, in which research and training are carried out in academic locales as an intrinsic part of graduate or advanced education Research, teaching and advanced study are thereby so closely interrelated that one informs the others (Clark, 1993, p. xx)

In this article we argue that the Brazilian experience exemplifies another side of this connection. One where it is the process of building the institutional conditions for a strong graduate tier that creates a protected space inside which research could be institutionalized and become a routine task for the academics, one that happens all year long, to be performed with as much assiduity as the teaching responsibilities¹.

To be sure, this process has had strong impacts on the final design of the research system in Brazil, some positive, and others, negative. In presenting some of the most relevant institutional traits of Brazilian graduate education, this paper seeks to explore some facets of its history and examine the link between graduate education and the research enterprise in the Brazilian experience. For the last part, we will use the data produced by a survey on the Brazilian academic profession from 2007, as part of the international project the “Changing Academic Profession” (CAP project).

Brazilian graduate education: an updated picture

While higher education in Brazil is plagued by many known problems, graduate education is a token of national pride recognized as such by the entire Brazilian society. The figures are impressive: in 2008, more than 88,000 students were enrolled in masters’ programs and a further 53,000 were enrolled in doctoral programs. In the same year, more than 33,000 masters and almost 11,000 doctors graduated in Brazil. These figures make Brazilian graduate education one of the most impressive within the emerging countries. However, Brazilian graduate education does not impress only by its size. Differing from what happens at the undergraduate level, Brazilian graduate education is impressive also for its quality. Since the mid-1970s the Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), the Ministry of Education’s agency in charge of graduate education, implemented a sophisticated evaluation process, based on peer-review,

¹ Brazilian higher education is organized according to the European model, according to which students enter the universities to obtain a professional degree, and eventually continue to postgraduate education at the masters’ or doctoral levels. So, there is no undergraduate education as such. However, to follow the usual Anglo-Saxon terminology, we use the expression “undergraduate” to refer to the first tier of professional education, and “graduate” to refer to the second and third tiers of masters’ and doctoral education.

that successfully connects performance with support, creating a virtuous circle that reinforces the best programs, while imposing a threshold for performance that limits growth without quality.

A brief history²

The beginning of graduate studies in Brazil can be traced to early experiences with the old chair system adopted by the first Brazilian University of Law in 1931. This was the period when the first Brazilian universities were created³ and when Brazil attracted a group of foreign scholars, escaping from the European turmoil of the 1930s. These academics brought to Brazil the European tradition of graduate certification. At its core was the tutorial relationship between the full professor and a few assistants who were supposed to assist the professor in his duties in teaching and research. Training was mostly informal and centered on the student's academic duties and his or her dissertation. The authority of the professor was almost absolute in assigning the assistant's academic workload, in determining the dissertation's content and methodology and in establishing the acceptable quality standards.

Until the 1950s, only a handful of academics obtained advanced degrees in Brazil, mostly at the Universities of São Paulo and Rio de Janeiro. At that time, graduate education had small impact on Brazilian higher education as a whole. One may even say that it was a small 'foreign' enterprise, tolerated by the academic authorities, but not deemed necessary. In a few institutions, graduate activities were a path (among others) for entry to an academic career. Outside the academy, a master's or doctoral degree had no relevance at all.

The first steps for recognition and regulation of graduate education in Brazil were taken in 1965. The main features were sketched by the Graduate Education Act 977, enacted by the Federal Council of Education (known in Brazil as *Parecer Sucupira*)⁴. This Act introduced a two-level structure for graduate studies, where students were supposed to successfully conclude a master's program prior to being accepted in a doctoral program. This is still the accepted format for graduate education in Brazil today.

The regulation of graduate education points to the Government's awareness of its potentialities as a domestic alternative to qualify academics for the growing federal network of universities. In 1968,

² This part of the paper is based on Balbachevsky (2004).

³ The first higher education institution founded in Brazil was the Imperial School of Law founded in 1808, when the Portuguese Royal Family fled to Brazil, escaping from Napoleon. From this beginning until the 1930s, the only institutional model for higher education known in Brazil was the non-university institution composed by single professional schools and providing training and certification for prestigious professions. These professional schools also adopted the chair model.

⁴ In Brazil, the Federal Education Council (called today the National Education Council) is a semi-autonomous collective body formed by education stakeholder representatives nominated by the Brazilian government, to regulate and establish education policies at all levels. The written opinions of its members, once approved at the Council's plenary session, become part of the country's education legislation.

the government also enacted a bill to reorganize the Brazilian universities after the U.S. model. This reform eliminated the old chair system, introduced the department model, inaugurated full-time contracts for faculty and replaced the traditional sequential course system by a credit system.

After the 1968 reform, graduate studies grew in the most prestigious universities and in some non-university research institutes, very often as semi-autonomous programs. In the new format, the tutorship was preserved but relations between the candidate and the tutor were now to be supervised by the graduate program's board. To successfully conclude their graduate studies, candidates were expected to accrue credits by attending specialized courses and culminated in a public defense of a thesis before a board of examiners — three in the case of a master's degree and five for a doctorate.

A decisive push for the growth of graduate education in Brazil emerged when these programs came to be defined as a privileged focus for policies supporting science and technology (Schwartzman, 1991) in the early 1970s. At that time Brazil was under an authoritarian regime with an important nationalistic orientation. In the 1950s, the Brazilian government had created a few research institutions, such as the National Research Council, the Brazilian Institute for Physics Research and the National Commission for Nuclear Energy, in the hope of participating in the post-war promised benefits from advanced technologies, particularly in the area of nuclear energy. In the late 1960s, for the first time, there was an attempt to link science and technology with higher education, as part of a broader project for economic development. This initiative can be best understood if one takes into account the consensus then built between influential scientists (some of them with well-known leftist orientations) and the nationalist sector in the Brazilian army, both supporting the idea of building an important sector of science and technology as an instrument for the country's economic development.

From the point of view of this scientific elite, the assumption was that, with adequate economic incentives, private investors would change their attitude from technology consumers to technology developers. This transformation would allow the country to break away from technological dependency, then diagnosed as one of the most important sources of economic underdevelopment. From the military's perspective, this objective was important also as a means to ensure access to sensitive technology in strategic fields such as nuclear energy, electronics and space research. Both stakeholders also converged on the best institutional model for achieving these goals: investments should be concentrated in a few large strategic projects from which scientific and technological competence were supposed to 'trickle down' into the economy and society. Graduate education was supposed to supply the sophisticated human capital deemed necessary for implementing these projects. Accordingly, the Brazilian government also launched an important program of scholarships for masters' and doctorate students abroad.

To achieve these objectives, the main Brazilian investment bank — the government-owned Banco Nacional de Desenvolvimento Econômico (BNDES) — established a program to support technological development in 1964. With the success of the fund, a new specialized agency, the Financiadora de Estudos e Projetos (FINEP), was created to be in charge of a new National Fund for

the development of science and technology, entitled to a permanent item of the Federal Budget. In 1975 the old and small Conselho Nacional de Pesquisa (National Research Council) was reformed into a larger Conselho Nacional de Desenvolvimento Científico e tecnológico (National Council for Scientific and Technological Development: CNPq), placed under control of the Ministry of Planning, then an important and strategic arm of the Brazilian government.

The 1970s were years of economic expansion, in which the Brazilian economy grew at annual rates of 7% to 10%. These new agencies had funds to spend, and a flexible and modern bureaucracy. Their first attempts were directed towards stimulating private and public firms to invest in technological development. Few of these initiatives succeeded, due the firms' lack of interest in investing in such risky enterprises, being placed, as they were, in the highly protected environment created by import substitution policies. Then, the agencies turned their attention towards the most prestigious universities, where some scientific tradition already existed. The strategy was to search for talented people in the academic institutions and provide them with direct support in research infrastructure and staff, as well as support for graduate education in the country and abroad, often by-passing university procedures and bureaucratic controls,

Thanks to these policies, a new generation of Brazilian researchers was created, many of them having graduated abroad, mostly in the United States. These young researchers came back to Brazil with a well defined picture of what should constitute a graduate program in an international perspective and how research was to be connected with graduate training. They were an important instrument for the dynamism one could find in these programs even in the earlier stages.

With such support, graduate education in Brazil grew at a great pace. In 1965, when the first rules and regulations for graduate education were established, the National Education Council accredited 38 graduate programs: 27 as masters' and 11 as doctoral degrees. Ten years later, in 1975, there were already 429 masters' programs, and 149 doctoral programs. These figures have grown continuously since then. In 2008, there were in Brazil 2,314 accredited masters' and 1,320 doctoral courses.

While FINEP and CNPq favored hard science and engineering, the Ministry of Education tended to support a broader range of fields, being focused, as it were, on faculty qualification. Since most of the undergraduate courses were in the soft fields, the Ministry's policy tended to favor graduate programs in these areas. In the end, with the overlap of policies of these two stakeholders, graduate education in Brazil became fairly well distributed among the major academic fields, as one can see in Table 1.

Table 1. Brazil: Master's and Doctoral programs enrolments, 2007

	Masters of Science	Doctoral programs
Agrarian Sciences & Forestry	8.7%	10.8%
Biological Sciences	6.5%	11.1%
Health Sciences	12.9%	15.1%
Mathematics, Physics	9.0%	11.6%
Humanities	18.3%	18.3%
Applied Social Science	14.9%	8.0%
Engineering	15.6%	14.0%
Fine Arts	7.4%	6.8%
Multidisciplinary	6.7%	4.3%
TOTAL (100%)	(78,771)	(47,200)

Source: Brazil's Ministry of Education, CAPES.

The quest for quality and evaluation

The 1965 Graduate Education Act conferred on the Ministry of Education's Conselho Federal de Educação (Federal Education Council) the responsibility for the programs' accreditation and evaluation. However, its earlier attempts to fulfill this role failed, for the lack of appropriate mechanisms and procedures. Lacking general standards, the S&T agencies had few clues in choosing to support or dismiss proposals from research-groups and postgraduate programs. CNPq had had some experience in peer-review procedures for individual projects, but not for programs as a whole. For the research groups, to attain high quality standards was crucial: it meant independence from the agencies' internal struggles and was perceived as an alternative for preserving the prestige associated with postgraduate education.

A solution to this impasse was reached when CAPES — then a Ministry of Education's agency in charge of providing scholarships for faculty and graduate students — organized the first general evaluation of graduate programs in 1976. The initiative was supposed to serve as guideline for allocating scholarships to students (Castro & Soares, 1986). Instead of making individual grants, CAPES decided to assess each graduate program as a whole, in terms of its academic output — mainly publications, number of degrees granted — and provide block grants to graduate programs according to their achievements. The assessment was done by peer-review teams, selected by CAPES according to nominations coming from the scientific associations, which were established to assess all graduate programs in their respective fields.

Eventually, as the CAPES evaluation became a routine procedure performed periodically and widely publicized, it was accepted by most stakeholders as a quality reference for postgraduate programs. In this way, the CAPES evaluation was converted in a strong policy instrument, successfully connecting performance with reward. The better the program evaluation, the greater its chances for accrued support as expressed in students' scholarships, research infrastructure and funds.

In spite of its positive aspects, the CAPES evaluation had some problems that became more and more apparent as time went by. The small size of the Brazilian scientific community and the visibility of the peer-committees work created unavoidable parochial pressures. One consequence was grade inflation. (Castro & Soares, 1986; CAPES, 1998) In 1996, four in every five programs were placed in the two highest ranks, A or B. It meant that CAPES evaluations were losing the ability for a discriminatory role.

Reacting to this situation, the CAPES authorities established in 1998 a new model for program evaluation. This new model preserves the authority of the peer-committees, but adopts more formal rules for evaluation. It reinforces the adoption of international standards for all fields of knowledge; imposes a set of parameters for faculty evaluation, stressing their academic background and research performance as measured by their publishing patterns; extends the periodicity of evaluation from two to three years; adopts a more comprehensive procedure, evaluating masters' and doctoral programs together, instead of evaluating each program *per se*; and adopts a seven point scale (instead of five), where the ranks of 6 and 7 are available only to programs offering doctoral degrees that could be assessed as good or excellent by international standards, and established that 3 was the lowest acceptable rank for a postgraduate program to be successfully accredited.

The 1998 evaluation round proceeded under these new rules. The results were satisfactory from the agency's point of view: by using the new criteria, only 30% of programs were ranked in the three highest positions (CAPES, 1999); ten years later, only 17.8% of the doctoral programs were still ranked in the two highest positions.

The place of graduate studies in the Brazilian higher education

Since the implementation of the 1968 reform, Brazilian higher education has been under strong pressure to diversify. By the late 1970s, its profile already showed the traits of a highly diverse and sharply stratified system: a public, tuition-free network of universities at the top and a large group of low quality, tuition-paying, small private non-university institutions at the bottom. In Brazil, the difference between university and non-university institutions is not related to the degrees they grant, but to the autonomy they enjoy. Formally, the legal value of a professional degree is the same regardless of the nature of the institution. But universities are free to decide how many students they can admit, while non-university institutions depend on the federal government for authorization. In principle, university status should be granted by the National Council of Education to institutions that provide graduate education in different subjects and have a significant number of full-time, highly qualified faculty. In practice, most public universities were created by law, and their university status cannot be revoked. On the other hand, most private institutions start as non-universities, but seek university status in order to increase their autonomy.

Among the public universities, a marked distinction should be made between the few that had succeeded in establishing a strong graduate level program, which we propose to call public research universities; and other public institutions (most of them also universities), which are mostly oriented toward undergraduate level and which we shall call regional universities.

The huge private sector, that provides about 75% of the country's undergraduate enrollments, has also experienced a sharp stratification, with the growth of a small segment of prestigious, elite private institutions, while the immense majority is still confined to a kind of "commodity-like" market of mass-undergraduate education. While any university is legally allowed to offer graduate education, the restrictions imposed by the CAPES evaluation have succeeded in limiting the growth of such programs in the private sector. In fact, 82% of the graduate students, and almost 90% of the doctoral students, are in public universities. In the private sector, there are graduate programs in a few Catholic universities and in other prestigious private institutions, particularly in the areas of social sciences and business.

The Brazilian masters' programs were not organized, as in the U.S., as market-oriented, professional degrees, but as mini-doctoral, academic programs for institutions that could not meet the requirements to provide full doctoral degrees. The 1997 Education Act (*Lei de Diretrizes e Bases da Educação*) required that higher education institutions should provide some kind of graduate education to obtain university status, and in many public institutions a graduate degree became a requisite for academic advancement. To fulfill this requirement, private institutions aspiring to university status created masters' programs that tend to be small, chronically undernourished and with few connections with the institution's real life. They are not supposed to grow and to occupy a place of their own inside the institution. They exist only for the sake of the indicators they produce. The 2007 national survey of the Brazilian academic profession, conducted under the guidelines of the CAP international project shows how the institutional environment affects academics' experience with graduate education.

As one can see in Table 2, teaching at the doctoral level is a common experience only for academics who are employed at the National public research institutes and at the public research universities. For academics from the other public universities and the elite private institutions, teaching only at the undergraduate level is the most frequent experience. Even so, in both kinds of institutions one can find a significant number of academics who are engaged in graduate education, some with the experience of teaching at the doctoral level, and others in masters' programs. At the private mass-oriented institutions, 93% of all academics teach only at the undergraduate level⁵.

⁵ Many institutions in the mass-private sector also are very active in continuing education. Thus, many academics from this sector also have experience of teaching in programs of professional specialization and other kinds of continuing education.

Table 2. Brazilian academics: highest teaching responsibility by institutional context

Academics' highest teaching responsibility	Type of institution					Total
	Public research institutes	Public research universities	Public regional universities	Private elite institutions	Private mass institutions	
Doctoral programs	69.2%	43.5%	16.2%	19.5%	1.9%	17.3%
Masters' Programs	15.4%	10.4%	21.3%	16.5%	5.1%	11.9%
Undergraduate programs	15.4%	46.1%	62.5%	64.0%	92.9%	70.8%
Total (100%)	39	193	277	164	468	1,141

Source: FAPESP/CAP project, Brazil 2007

Teaching and advising in graduate programs: the academic profile

The processes described above have made graduate education in Brazil highly selective and demanding for academics. The 2007 national survey on Brazilian academics, as part of the international CAP project presents some relevant indicators in this dimension. Although this survey did not ask if the academic advises doctoral dissertations or masters' theses, by selecting those that gave a positive answer when asked if they teach classes for masters' and/or doctoral programs a broad identification of the academics that have connections with graduate education can be made. In order to be allowed to advise on graduate work, an academic must be accepted by the graduate school or the collegiate department. In this process, the first step is being allowed to teach a graduate program. The second step is to be recognized as an advisor at the master's level, which usually comes after one or two terms of teaching in graduate programs. Authorization for advising doctoral theses — when the program is allowed to confer doctoral degrees — comes after the first advised master's thesis is successfully approved. Thus, identifying academics who teach at the graduate level is a good proxy for identifying academics who also provide advice on masters' theses and/or doctoral dissertations. Table 3 shows that teaching at graduate level, and, especially, teaching in doctoral programs requires that an academic holds a PhD degree.

Teaching at graduate level also requires a strong commitment to research. By following the international literature, academics can be regarded as experienced researchers if they are able to disseminate the research findings to a wider audience, which, for many, means to publish these findings (Fulton & Trow, 1975). In the Brazilian context, fully fledged researchers are also expected to have the skills and experience needed to raise external support for their research activities. It is not usual for public institutions in Brazil to set aside institutional resources to support research. In the private sector, even when institutions earmark small amounts of funds to support academics' research, access to these resources is not regulated by academic norms. They usually stay under the

discretionary control of the institution's authorities. Therefore, one can assume that, in the Brazilian context, being able to command external funds means also that academics' research agendas have been evaluated by their peers.

Table 3. Proportion of academics holding a doctoral degree by their highest teaching responsibility

Type of institution	Highest teaching level		
	Doctoral programs	Masters' programs	Undergraduate programs
Public research institutes	100.0%	100.0%	66.7%
Public research universities	100.0%	100.0%	85.4%
Public regional universities	93.3%	98.3%	46.2%
Private elite institutions	96.9%	92.6%	60.0%
Private Mass institutions	66.7%	87.5%	26.0%

Source: FAPESP/CAP project, Brazil 2007

Table 4, ranks the degree of commitment to research among Brazilian academics. The scale runs from a fully professionalized researcher (one who performs research, publishes and is able to secure external support) through to one with a non-active role. In between these extremes, there can be identified those that do research and publish but cannot secure external support and those that perform research without achieving any publication of or support for the work.

Table 4. Brazilian academic's research profile and teaching responsibilities

Research Profile	Highest teaching level			Total
	Doctoral programs	Masters' Programs	Undergraduate programs	
Fully-fledged researcher	64.0%	41.2%	12.4%	24,7%
Doing research and publishing without external support	28.4%	46.3%	37.3%	36,8%
Doing research without publishing and external support	3.0%	8.1%	16.0%	12,8%
Inactive as researcher	4.6%	4.4%	34.4%	25,7%
Total (100%)	197	136	808	1,141

Source: FAPESP/CAP project, Brazil 2007

As one can see in this table, there is a strong association between having the profile of a fully-fledged researcher and teaching in doctoral and masters' programs. On the other hand, the second group, of those that publish but have no success in securing external funds, has a weak (but significant) association with teaching at masters' level. In the final two groups the commitment to research reaches the lower level: academics who either do not do research at all, or, if they do, have not published in the last three years prior to the interview nor have had access to external funds to support their research. These profiles are strongly associated with teaching only at the undergraduate level and are almost absent among academics teaching at the graduate level.

Furthermore, as shown in Table 5, experienced researchers, with active international connections usually have teaching responsibilities in doctoral programs, while those confined to domestic networks are associated with teaching at masters' level. Researchers with only parochial (institutional) networks and those who develop research only in isolation are associated with the undergraduate level.

Table 5. Research network and teaching responsibilities

Research network	Highest teaching level			Total
	Doctoral programs	Masters' Programs	Undergraduate programs	
Researcher with international connections	56.5%	31.0%	16.0%	27,3%
Researcher with domestic connections	26.1%	44.4%	34.3%	34,0%
Researcher with institutional connections	11.4%	19.0%	27.2%	22,4%
Isolated researcher	6.0%	5.6%	22.5%	16,3%
Total	184	126	519	829

Source: FAPESP/CAP project, Brazil 2007

The higher commitment to research found among the academics working in graduate education has predictable effects on their productivity, as estimated by the number of works published in the last three years⁶. Table 6, compares the productivity of academics with different teaching profiles in the last three years.

Table 6 shows significant differences in the level of productivity associated with different levels of teaching responsibilities. In fact, while academics teaching in doctoral programs have 20 weighted publications in the last three-years, this number falls to 14 among academics teaching in masters' programs and to only 7 among academics with responsibilities only at the undergraduate

⁶ In order to overcome the problems associated with the differences in the lengths of work that are required to publish a book when compared with publishing a paper, the information presented by the academics regarding their scholarly contributions was weighted. The number of books reported by the academic was weighted 4, the number of books edited was weighted 2, and both added to the number of papers published in scholarly journals or presented at scholarly conferences.

level. What is more important, the analysis of variance (ANOVA) shows that teaching at different levels explains almost 14% of all variance in productivity.

Academics who work in graduate education, and especially those in doctoral programs, are not only more productive. The CAP study also found that their publishing activity is done in a richer context, counting on the help of peer-revision and collaboration of colleagues from abroad and domestically.

Table 6. Differences in productivity, as measured by the number of works published in the last three years

Summary (means and standard deviation)

Highest teaching level	Mean	N	Std. Deviation
Doctoral programs	20.0863	197	17.01793
Masters' programs	14.7500	136	14.05057
Undergraduate programs	7.1052	808	11.40197
Total	10.2577	1,141	13.83278

ANOVA Table

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups (Combined)	29805.154	2	14902.577	90.051	.000
Within Groups	188329.091	1,138	165.491		
Total	218134.245	1,140			

Measures of Association

	Eta	Eta Squared
Production_Total Highest teaching level	.370	.137

Source: FAPESP/CAP project, Brazil 2007

In fact, as can be seen in Table 7, 74% of the academics with responsibilities in doctoral programs have their publications subject to peer-review. Among them, 33.1% published in co-authorship with foreign colleagues and another 31.5% published with colleagues in Brazil. In the second group, 59.9% of the academics with teaching responsibilities at masters' level have work published with peer-review. Among them, only 11.5% published in co-authorship with foreign colleagues but 36.1% published in collaboration with colleagues in Brazil. Finally, academics with teaching responsibilities confined to undergraduate level tend to show a more impoverished profile of

publications: when they have works published (because 25.4% of them have had no work published at all), they usually publish alone and without peer-review.

By way of conclusion, one can say that in Brazil, graduate education, and more specifically, the doctoral programs are, in fact, places where research found all the requisites to be institutionalized inside Brazilian higher education. The micro-environment of these programs is such that it successfully concentrates academics with dynamic profiles as researchers, with intense activity in international networking and publishing, creating an energetic and demanding environment for its students.

Table 7. Patterns of publishing and teaching responsibilities

Patterns of publishing	Highest teaching level			Total
	Doctoral programs	Masters' Programs	Undergraduate programs	
production with peer-review, local and foreign co-author	33.1%	11.5%	5.2%	12.3%
production with peer review and local coauthor	31.5%	36.1%	20.2%	25.0%
production with peer-review, no co-author	9.4%	12.3%	7.2%	8.4%
production with local co-author, no peer-review	17.1%	19.7%	22.3%	20.8%
production without peer-review and co-author	4.4%	11.5%	19.8%	15.1%
no publications	4.4%	9.0%	25.4%	18.3%
Total	181	122	516	819

Source: FAPESP/CAP project, Brazil 2007

The graduate foundations of research in Brazil

This article started with a quotation from Burton Clark where he describes one of the most striking features of modern higher education, that is, the coupling of research with teaching. In his analysis, Clark (1993) states that this nexus is especially strong inside the higher levels of learning, that is, in graduate education. However, in his formulation, research and knowledge creation are deemed a necessary condition for a vigorous system of higher learning to be built. The title of this article inverts the terms of his proposition. We argue that in the Brazilian experience, graduate education and not research comes first. One of the factors explaining the success of Brazilian higher education in building a strong research profile is hidden in its success in building a strong tier of graduate education. Our analysis shows how graduate education in Brazil emerged in the 1970s as a by-product of the consensus built between political leaders, policy makers and the domestic leaders in scientific disciplines around a project that puts science as a core policy for promoting the country's economic development and independence. And as it grew, it created the necessary conditions for

research to become institutionalized inside the small number of Brazilian universities that had succeeded in developing a robust tier of graduate education.

Pivotal to this process was the institutionalization of the procedures for program evaluation. As was said in the first part of this article, the strong legitimacy of these procedures rested in the work done by the committees of peers that CAPES was able to mobilize for these evaluations.

The work of these committees had a major impact on the institutionalization of academic research in Brazil. In each recognized field, they became a major forum for establishing quality standards for research, for legitimizing subjects of study, theories and methodologies, and for evaluating international links and publishing patterns (Coutinho, 1996). Thus, one can see the work of these evaluation committees as one of the most effective instruments for expediting the institutionalization of all fields of knowledge and in building the foundations of the Brazilian scientific community (Schwartzman, 1991).

While the first committees were chosen by an *ad-hoc* procedure among the most influential scientific leaders in Brazil, as the CAPES evaluation became institutionalized, the composition of these committees became more stable, but at the same time the nomination process was converted into an arena where different research traditions and groups struggled to be represented. This process presents few difficulties in areas where scientific consensus is broad and the research agenda is more or less consensual. But in fields where these characteristics are not present, this struggle is fierce and the committees' decisions had major impacts over the different research traditions. As quality tends to be defined in terms of what is done by the most powerful groups inside each field, the whole process is by its nature very conservative, and creates artificial obstacles for the growth of new research areas, especially when they are born in-between the rigid boundaries CAPES evaluation defines for different fields. Thus, it is not surprising that 54% of all graduate programs formally classified as "multidisciplinary" are ranked at the lowest position of the CAPES evaluation scale.

In fact, multi- and trans-disciplinary research areas are particularly affected by the compositional effects created by the peculiar relations between graduate education and research in Brazil. CAPES evaluation is simply unable to deal with the peculiarities presented by research groups (and graduate programs) working with a more trans-disciplinary orientation. Many of them are forced to fit into one or other area committee, where they are seen as a kind of "ugly duckling", to whom no metric of beauty or excellence can be properly applied. Others also are condemned to the limbo represented by the "multidisciplinary" committee, where evaluation is forced to emulate the norms adopted for the more disciplinary oriented committees. Finally, others are simply dismissed.

One of the most relevant features of the 1998 reform of CAPES evaluation was the adoption of a number of indicators that should be used by the committees when evaluating a program. This procedure was very effective in counteracting the parochial pressures to which all the committees were exposed. Nevertheless, the new instrument reinforced the role played by the CAPES bureaucracy. Because of the peculiar centrality that graduate programs even now play in the process of

institutionalization of science in Brazil, this change in the balance of power in favor of the bureaucracy introduced further constraints over the processes supporting diversification in science.

The strong ties that connect all the building blocks of graduate education in Brazil also restrict the autonomous growth and diversification of the masters' programs. In most countries masters' programs have tended to disengage themselves from the trajectory pursued by doctoral programs. In doing so, these programs have established their own identity and relevance as they become places for advanced training for an increasingly demanding labor market. In Brazil masters' programs are still conceived mainly as a kind of 'mini-doctorate', an intermediate stage mandatory for anyone who wants to attend a doctoral program. This situation prolongs unnecessarily the time needed for training the new generation of researchers. CAPES officials estimate that in order to conclude a masters' degree, a student would spend 34 months, on average (almost 3 years). To achieve a doctoral degree, it takes an additional 53 months (four and half years). It also freezes the masters' programs in an adjunct role, inhibiting growth and diversification, and hindering the potentialities this kind of study has for upgrading the competences of society as whole⁷.

Conclusion

In the 1970s, Brazil started a significant effort to build science, technology and graduate education as part of a broader project of modernization and economic growth. However, while the links between research and development remained limited at best, graduate education grew as part of an expanding higher education system, establishing the conditions but also the limits for academic research to develop. The analysis shows how effective has been the evaluation process in preserving the special features of this structure inside Brazilian higher education. Even so, the article also points out some of the more relevant constraints and challenges for this overall successful policy. One of the unintended consequences of this emphasis on the assessment of the academic quality of the graduate programs is that it penalizes both applied and interdisciplinary work, which is essential for university research to transcend their institutional boundaries and link more strongly with society (Schwartzman, 2008). We may be reaching a turning point when the hindrances created by academic over-regulation surpass its benefits. How the Brazilian science community, the policy makers and society as a whole are going to deal with these new challenges is, at present, an open question.

⁷ In 1997 CAPES also recognized a new kind of masters' degree called the "professional master program". Nevertheless, this initiative was never fully accepted by the evaluation committees nor by the public universities. As a result, 10 years after proposing the new alternative format for a masters' program, there are only 662 programs of this kind, attended by only 7,000 students.

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