Unclassified **DSTI/EAS/STP/NESTI/RD(2004)20**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development **17-Sep-2004**

English text only

DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INDUSTRY
COMMITTEE FOR SCIENTIFIC AND TECHNOLOGICAL POLICY

DSTI/EAS/STP/NESTI/RD(2004)20
Unclassified

Working Party of National Experts on Science and Technology Indicators

ARGENTINIAN DOCTORATE HOLDERS' CAREERS: ISSUES AND PROBLEMS

WORKSHOP ON USER NEEDS FOR INDICATORS ON CAREERS OF DOCTORATE HOLDERS
OECD, Paris-La Défense, 27 September 2004

Contact: Mr. Mario Albornoz and Mr. Lucas Luchilo, Centro Redes/IberoAmerican Network of Indicators of S&T (RICYT); E-m: albornoz@ricyt.edu.ar and luchilo@ricyt.edu.ar

JT00169448

English text only

ARGENTINIAN DOCTORATE HOLDERS' CAREERS: ISSUES AND PROBLEMS

Mario Albornoz and Lucas Luchilo*

1. The number of researchers and their mobility patterns within a country and from one country to another provide valuable information to estimate the capabilities and possibilities of their national innovation systems. Knowledge about researchers' professional activities and careers are no less relevant. However, up to the moment, this last issue has not been sufficiently taken into account, at least in Argentina. An international study of doctorate holders' careers could contribute to supply, at least partly, this great lack of information.

2. We will start our presentation by stating the reasons why professional careers of Argentinian doctorate holders are an interesting subject of study, as well as mentioning some of the obstacles which hinder their analysis, derived from the features of our national universitary and scientific system. In the second place, we will present the main trends of doctorate education in our country, paying special attention to changes which have been taking place since the nineties, while postgraduate studies grew hastily. In the third place, we will briefly analyse some information about trends in doctorate holders' employment. Finally, we will end our presentation with some remarks on the conditions required to conduct a survey about Argentinian doctorate holders' careers.

1. Reasons to study doctorate holders' professional careers

3. We believe that there are three kinds of reasons to pay further attention to doctorate holders' careers:

1.1. Reasons related to public policies on science and technology and on higher education

4. From the point of view of national authorities in science and technology and in higher education, it is specially important to possess a more detailed and comprehensive data basis. In June 2004, SECYT (Secretaría de Ciencia, Tecnología e Innovación Productiva – Science, Technology and Productive Innovation Department) conducted a *National survey about expectations on capabilities in science, technology and innovation*, which was answered by 3700 people, including 3000 researchers.

5. One of the issues included in the survey were the directions of public policies considered of importance for the country. The policy that received best acceptance was supporting doctorate programs developed in Argentina. This general perception of the need to strengthen doctorate programs and the basis of human resources devoted to research is also apparent in CONICET's (Consejo Nacional de Investigaciones Científicas y Tecnológicas – National Council of Scientific and Technological Research) decision to establish as a goal for the three next years a 45% rise of its staff of researchers and a three times rise of its doctorate scholarships. Both the researchers' perception about the relevance of supporting doctorate programs and CONICET's decision are based, as we shall see, on a doubtless shortage of doctorate holders. However, our authorities lack good information about important issues in doctorate programs and

* Centro Redes/RICYT.

doctorate holders' careers, so that the efforts they intend to make in the next years to support an ambitious program of education can lead to an efficient use of the resulting human resources.

6. According to the needs of higher education policies, different systems of evaluation and accreditation for postgraduate courses –including doctorates– have been developed, which provide good information about the quality of national doctorate programs. This information is used at the evaluation of candidates for doctorate scholarships. In spite of these advancements, most universities have not followed systematic policies to improve their doctorate programs. Usually, institutions neither evaluate the results of their programs nor keep contact with their postgraduates to obtain information about their careers.

7. Lately, concern about human resources availability has been emphasized within science and technology policies in our country. It has become apparent that Argentina is losing its relative advantages with regard to other countries of the area, as it clearly appears in the increasing gap between Argentina and Brazil in terms of doctorate holders' number and mobility. The continuous drain of researchers towards foreign countries adds to this concern, which becomes stronger when the aging of the scientific corps is acknowledged. These concerns, derived from an inner view of the scientific system, join another one, regarding the availability of qualified human resources required to maintain a national development policy with special attention to innovation.

8. Some universities or university departments have started to show their interest in the professional performance of their graduates and postgraduates, partly related to their need to attract students – particularly for postgraduate studies. This interest adds up to the even deeper concern involving teachers' recruiting. It is possible to state that the new mechanisms of evaluation and accreditation of universities and careers, as well as the institutional development and diversification of the higher education system have stimulated an increasing competitiveness to obtain human resources for teaching and research, and that holding a doctorate is a most valuable item, which shows an alteration in the traditional trend. Since this competitiveness is likely to become more intense, information about doctorates will become more useful.

1.2. Reasons involving producers of specific data

9. Our previous remarks about policies on science, technology and higher education imply a number of demands made to institutions responsible for producing specific data. In the nineties, the prevailing policy regarding higher education dealt with issues related to institutional development and diversification, strengthening of undergraduate teaching, and evaluation and accreditation. Although some of these issues meant supporting human resources policies, this subject was not specifically focused. Although science and technology policies were deeply unstable, the national authorities introduced some institutional innovations regarding project financing. Besides, policies aiming to reduce public expenditure affected crews and careers of researchers, professionals and technicians within science and technology national public institutions.

10. In the same period, economic policies followed had a strong impact on employment situation. Along the decade, the unemployment rate became three times higher. As regards university professionals, although unemployment rates are still lower, they have proportionally undergone a greater increase.

11. The policy trends we have mentioned did not require a great amount of information on HRST, particularly about doctorates. However, information systems improved as a whole and were able to offer interesting data on number and training of human resources. Nevertheless, other issues, such as needs of human resources in specific areas, demographic diagnoses and projections of scientific community, agreements and disagreements between labor market demands and the kind of training offered by universities, or researchers' migration, did not receive the attention they deserved. To certain extent, the

various state and social actors did not feel the need to take sides or make decisions about these issues. Consequently, their demands for information were limited.

12. Although it cannot be said that, at the moment, a new agenda of science, technology and higher education policies has been firmly established, it is absolutely clear that the one elaborated in the last decade has been left aside, and some of the issues which had been forgotten – such as those related to human resources– have now become more relevant. This updating of the agenda ensues the increasing evidence of some phenomena –migration of professionals, difficulties encountered by firms to hire personnel with specific professional and technique profiles– as well as a change in the direction of the government policies, quite distant from the market-oriented policies of the last decade.

13. These changes involve further demands for information. At the moment, information about postgraduate courses, particularly doctorate programs, is fragmentary, scattered and incomplete. As we will explain in the following section, there is neither updated and available aggregate information about the number of students who obtain their doctorate degree per year nor about the areas and science they choose for their specialization. It is also hard to find a reliable estimation concerning the total number of doctorate holders in Argentina, their basic demographic characteristics, the kinds of jobs they have, their educational or professional career. Given these deficiencies, it is urgent to improve our information and knowledge about this matter.

1.3. Reasons involving researchers in subjects dealing with science, technology and higher education

14. The study of doctorate holders' professional careers is an interesting subject from the point of view of social research in science, technology and higher education. Information obtained from the study of doctorate holders' careers can help to understand some aspects of the way in which doctorate programs work. It will enable us to collect data regarding efficiency, links between postgraduate programs and lines of research lines, and relation to economic sectors.

15. Data about employment of doctorate holders will help to enlighten poorly known aspects about the dynamics of labor markets where researchers are included, regarding both the time that takes them to get a job and the kinds of engagement and salary scales. It is also possible that a more precise knowledge about these aspects should contribute to a better understanding of the causes of young researchers' tendency to emigrate. In the same direction, questions about the country where they have obtained their doctorate degree and their posdoctorate experience abroad can help to outline the processes of international mobility of Argentinian researchers.

2. Recent trends in doctorate training

2.1. Background

16. During the last fifteen years, significant changes in doctorate training occurred in Argentina. Up to the end of the eighties, postgraduate education had attained little development. Education offers concentrated in two types of postgraduate programs: specialization careers and doctorates. Specialization careers prevailed in medical sciences. Doctorates were of two kinds. One of them was a doctorate *stricto sensu*, aimed to research and requiring the elaboration of an original thesis. This kind of doctorate existed almost exclusively in exact and natural sciences. The other kind of doctorate was related to traditional careers which prevailed in Argentinian universities, especially in Medical Studies and Law. Doctorates in Medical Studies had not had, for many years, strict requirements of postgraduate studies and consisted, in fact, of a routine thesis that was elaborated at the end of undergraduate studies, as a condition for professional practicing. In other areas, such as Law teaching, there also existed some doctorates similar to

that of Medical Studies, aimed to add professional prestige symbols and not to produce further knowledge. This second kind of doctorate had been losing significance as time went by, as shown in table Nº 1.

Table 1. **National universities: new doctorate holders by fields of science (every five years, 1950-1988)**

Field of science	*Sum total*	*1950-1954*	*1955-1959*	*1960-1964*	*1965-1969*	*1970-1974*	*1975-1989*	*1980-1984*	*1985-1988*
Basic and technological sciences	*5,153*	*764*	*583*	*542*	*504*	*750*	*650*	*684*	*676*
Social sciences	*2,453*	*471*	*449*	*279*	*508*	*341*	*181*	*145*	*79*
Human Sciences	*365*	*44*	*26*	*32*	*33*	*66*	*46*	*77*	*41*
Medical Sciences	*8,471*	*1,299*	*1,545*	*1,609*	*1,700*	*826*	*514*	*628*	*350*
Total	*16,442*	*2,578*	*2,603*	*2,462*	*2,745*	*1,983*	*1,391*	*1,534*	*1,146*

Source: De Imaz et al., 1992.

17. As the table lets us know, research doctorates were concentrated in basic and technological sciences. Doctorates in humanities appear in very low proportion. Doctorates in medical sciences and social sciences –including Law– prevail; they diminish gradually, along with the strengthening of the idea that the doctorate degree is destined for research doctorates.

18. The idea of the doctorate as a degree that required specialized training and the elaboration of an original thesis started to gain force in the middle fifties in faculties and departments of exact and natural sciences in national universities. Only in the late eighties did it become a general principle, as a result of some decisions taken by several universities and by national authorities in university policies. The main initiative in this direction was the regulation established by the University of Buenos Aires about the profiles and conditions demanded from postgraduate programs. This regulation was adopted by the national Ministry of Education, which propounded, in 1985, the creation of the Sistema Interuniversitario de Cuarto Nivel (SICUN / Fourth Level Interuniversitary System). Concurrently, the CONICET created, in 1988, a program of doctoral and postdoctoral scholarships. This program gradually replaced the previous scholarship system, which did not state the obtaining of a doctorate degree as a necessary requirement for the advancement within the research career. Although the sum of these initiatives did not make an altogether consistent policy, they were the ground for later regulations.

2.2. Development of postgraduate studies

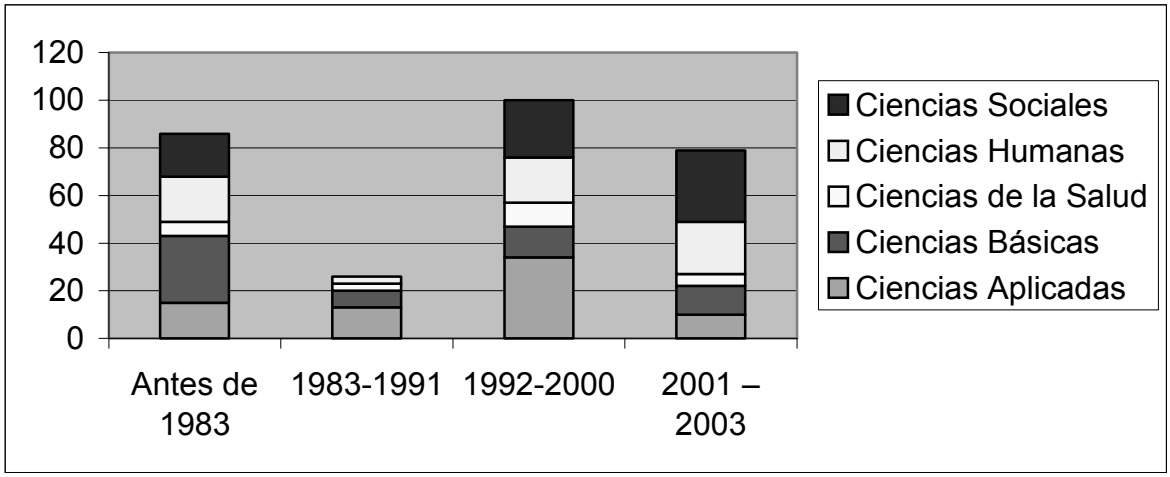
19. While these attempts to regulate a postgraduate system were being performed, a sudden increase of supply and demand of postgraduate education took place. The most significant features of this process of development were the growing supply of postgraduate programs, the diversification of programs and institutions, and the increase in matriculation. This process came together with the development of a national postgraduate programs accreditation system, aimed to assess the quality of the various programs.

2.2.1. The growth of graduate programs

20. As graduate programs supply is concerned, until 1985 there were 207 programs of this kind. Between 1986 and 1994, 368 new postgraduate programs were created; in the nine years that followed 1,300 new programs were added. In other words, in ten years postgraduate programs had tripled.

21. Although the growth of graduate programs supply was mainly due to the creation of masters, in 1989 doctorate programs supply also started to increase significantly. As shown in graph Nº 1, between 1983 and 2003 the number of doctorate programs jumped from 86 to 291. The greater increase occurred between 2000 and 2003, when 79 programs were created. This increase is mainly due to the creation of doctorate programs in areas where the previous supply was non-existent. Social sciences, for instance, went from 18 programs in 1991 to 72 in 2003; human sciences went from 22 to 63 along the same space of time.

Graph 1. **Changes in doctorate programs offered by field of science, before 1983-2003 (n=1975)**



Source: Jeppesen et al, 2004.

2.2.2. Diversification of programs and institutions

22. Diversification of institutions was the result of two complementary processes. On one hand, it derived from the general process of increase and diversification of the university system which occurred after 1989. At that time there were 29 public universities and 23 private ones. Fifteen years later, there were 45 public universities and 53 private ones. Most new universities organized postgraduate activities. On the other hand, some preexisting universities, which had not payed attention to graduate education, decided to follow a more active policy in this matter.

23. Postgraduate programs offered by private universities increased their number in greater proportion than public universities. Situations previous to 1989 –when the new universities had not yet been created– and from 1989 to 2003 can be observed in table Nº 2. In this period, one third of the new postgraduate creations belong to private universities, whereas in the preceding period private universities offered only 15% of the graduate programs.

Table 2. **Postgraduate programs in public and private universities, before 1989 and from 1989 to 2003**

	Before 1989		*1989 to 2003*	
	Public universities	***Private universities***	***Public universities***	***Private universities***
Specialization careers	*112*	*16*	*584*	*238*
Masters	*38*	*8*	*469*	*228*
Doctorates	*81*	*19*	*148*	*53*
Total	*231*	*43*	*1,201*	*519*
Percentage	*84.2*	*15.8*	*66.9*	*33.1*

24. The main item that brought about the diversification of postgraduate education supply was the increase of masters programs. Almost 50% of the postgraduate programs created after 1995 are masters. The growth of masters was particularly relevant in the area of social sciences, where there was a significant increase of the private institutions.

Table 3. **Postgraduate programs by field of science, before 1983-2003**

	Applied Sciences	**Basic Sciences**	**Health Sciences**	**Human Sciences**	**Social Sciences**	**Total**
Before 1983	32	30	60	22	30	174
1983 - 1985	9	3	10	3	8	33
1986 - 1988	8	7	19	3	30	67
1989 - 1991	19	2	41	2	26	90
1992 - 1994	50	9	87	16	50	212
1995 - 1997	83	17	118	67	117	402
1998 - 2000	91	10	82	61	123	367
2001 - 2003	127	18	148	103	234	630
Total	**419**	**96**	**565**	**277**	**618**	**1,975**

Source: CONEAU (2003).

2.2.3. The increase of matriculation

25. The enormous increase shown in the number of graduate programs was accompanied by a significant growth of matriculation. The first thorough reckoning of postgraduate students was held in 1997 and registered a total number of 31,857 students, 76% attending public universities and 24%, private ones. Table Nº 4 shows their distribution by kind of postgraduate program. 15.2% are doctorate programs students.

Table 4. **Graduate students by type of institution and type of graduate program, 1997**

Type of institution	*Total*	*Doctorate*	*Masters*	*Specialization*
National universities	*23,598*	*3,403*	*9,734*	*10,461*
Private universities	*8,022*	*1,453*	*3,933*	*2,636*
Other university institutions	*237*	*-*	*169*	*68*
Total	*31,857*	*4,856*	*13,836*	*13,165*

Source: SPU (1997).

26. Statistics provided by Secretaría de Políticas Universitarias (University Policies Secretariat) for the following years do not enable us to describe the evolution of matriculation in doctorate programs. Available data only register postgraduate matriculation in national universities. There is a significant lack of data regarding private universities, especially in social sciences masters. In any case, available data provide us with a rough estimation of the number of students.

27. Information about graduate students in 2000 is restricted to national universities –with some important exceptions, such as the University of La Plata. The total number of postgraduate students amounts to 29,542. Since universities that have not provided information about postgraduate students involve around 15% of the undergraduate matriculation of the national universities (but, at the same time, some of them have not developed a relevant activity regarding postgraduate programs), we can assume an increase of little more than 10% over the total registered. Therefore, the total number of postgraduate students at national universities in 2000 could possibly be around 33,000.[1] Assuming a similar proportional growth in private universities matriculation, the total amount of postgraduate students in 2000 would be around 44,000. ¿How many of those students are following doctorate programs? Assuming the same proportion as the one registered in 1997, the total amount of doctorate students should be around 6,500. Nevertheless, the real number is likely to be a little lower, since masters were the graduate programs which most increased between 1997 and 2000, so they are likely to have concentrated the increase in matriculation.

2.2.4. Postgraduate programs accreditation

28. Facing this process of growth and diversification of postgraduate programs supply, the national State took different steps. On one hand, law Nº 24521 on higher education established the general conditions which would be required from postgraduate studies. That same law stated that every graduate program had to be approved by the CONEAU (Comisión Nacional de Evaluación y Acreditación Universitaria / National University Evaluation and Accreditation Commission) or by the private entities that were created with that goal and were acknowledged by Ministry of Education, Science and Technology. Accreditation should be based on the standards established by the Ministry together with the Universities Council. A set of regulations derived from the law defined the accreditation procedures which would be followed both for traditional and distance programs, already functioning or presented as projects.

29. CONEAU has established three accreditation categories: programs can belong to A category if they are rated excellent; to B category, if they are considered very good, and to C if they are rated of good

1. Ana Fanelli (2004) estimates that in 2000, 32,643 postgraduate students were taking courses at national universities.

quality. Those which do not meet the minimum standard are not accredited. Results are public and accreditations are valid for three or six years. Failing to be accredited has no direct consequences. Although CONEAU is entitled to recommend that registration of new students should be suspended in programs which have not met the minimum standards, it has not made any decisions in that direction up to the moment; its only step has been to publish the information and provide it to the university authorities.

30. This process of accreditation has been efficient: in six years, 2151 programs were accredited. However, specialists highlight two kinds of problems. One of them regards methodological issues of evaluation –definition of the type of program, definition and assignment of values to variables and indicators, variation of quality criteria according to the branch of studies, heterogeneity of criteria used by people in charge of the evaluation. The other one, with a wider scope, refers to the fact that evaluation and accreditation policies are often dissociated from budget decisions.

2.3. Doctorate holders' education: present situation

31. The present situation in doctorate holders' education reveals severe limitations of our university system to train a significant number of good quality doctorate holders. The number of students per year who obtain their doctorate degree is very low. The proportion of doctorate students within the total matriculation is also low. Complementarily, rates of graduation are low, and the actual duration of courses is much greater than their nominal duration, as it is also frequent in postgraduate courses. Training is especially concentrated in branches of study related to exact and natural sciences, and in few institutions. Finally, the number of students who obtain their doctorate degree abroad –which brings about the migration of scientists– is immoderately high.

2.3.1. Low number of doctorate degrees per year

32. No official data about yearly production of doctorate degrees are available. On the basis of estimates regarding various doctorate samples (Barsky, 1997, 1999; Jeppesen et al, 2004) and figures for 1997 provided by Ministry of Education, Science and Technology, it can be stated that the yearly number of students obtaining their doctorate degree at the end of the nineties was around 400. This means less than one tenth of the doctorate students who yearly obtain their degree in Brazil and 40% of those who obtain it in Mexico.

2.3.2. Low proportion of postgraduate students within total matriculation

33. According to data registered by Ministry of Education in 1997 and more recent estimates, in 2000 the number of postgraduate students was around 40,000, over a total of 1,124,000 students, namely a little less than 4%. In developed countries, this proportion is much higher, between 10 and 25%.

2.3.3. High percentage of doctorate programs with very low matriculation and graduation

34. As we have previously stated, there are 291 doctorate programs, for an estimated total of around 6,000 doctorate students, which means an average number of 21 students per program. However, very few programs concentrated most doctorate students. Some ten programs in University of Buenos Aires in exact and natural sciences involve near 20% of doctorate students in the country.

2.3.4. Low graduation rates and long duration of courses

35. Argentinian postgraduate programs tend to replicate some of the features of undergraduate training. One of those features is very low efficiency, considered in terms of the duration of courses and rates of graduation. A recent estimate based on a representative sample of postgraduate programs registers a graduation rate of 14.8% (Jeppesen, 2004, p. 73). In exact and natural sciences –where most postgraduate

programs are doctorates– this proportion doubles the average. Some data about the duration of courses can be obtained examining the same sample. Less than 15% of the students starting in 1998 their graduate programs in exact sciences –whose nominal duration ranges between two and four years– had finished their studies at the end of 2003.

36. Problems of efficiency appear as well when we focus the proportion of students who do not elaborate their thesis, and those who give up before finishing the postgraduate courses. For instance, in the most relatively efficient area –medical sciences–, around 40% of students give up before finishing their courses. Reasons for low efficiency of doctorate programs can be found both in the administration of the curriculum and in postgraduate students' financial restrictions. Problems of curriculum administration are of different kind and their importance varies according with the area and the specific program involved. The most frequent problems are delays in admission procedures, in the approval of projects of theses and in jury summoning, and a deficient supply of postgraduate seminars.

37. As far as postgraduate students, in general, and doctorate students, in particular, are concerned, the relative shortage of scholarships and the high percentage of students working more than 25 hours per week hinder regularity in studies. In the case of University of Buenos Aires –concentrating around 25% of postgraduate students and an even higher percentage of doctorate ones– student census held in 2000 shows that 85% of postgraduate students worked more than 26 hours per week and 75%, more than 35 hours per week. The proportion of students enjoying scholarships was very low, slightly lower than 20%. In the case of Faculty of Exact and Natural Sciences –the main institution in Argentina in terms of the number of their doctorate holders–, it was 60%.

2.3.5. Concentration in exact and natural sciences

38. Doctorates in exact and natural sciences provide between 50 and 60% of doctorate holders. Engineering and technology doctorates waver around 10%. In the former years, matriculation and graduation in social sciences and humanities has increased significantly. Within exact and natural sciences, postgraduate training is also highly concentrated. Almost 50% of doctorate holders in that area have received their degree at the Faculty of Exact and Natural Sciences of University of Buenos Aires.

2.3.6. Significance of the doctorate degrees obtained abroad

39. A significant percentage of Argentinian university graduates who follow doctorate programs do so in foreign countries. We do not have data from Europe, but information from the United States registers a great number of Argentinian who obtain their doctorate degree every year. According to Science and Engineering Doctorate Awards from National Science Foundation, from 1993 to 2002, 636 Argentinian people obtained a doctorate degree in science and engineering. Assuming that during those years there may have been around 2,000 or 2,500 students who obtained their doctorate degree in science and engineering at Argentinian universities, 25% or 30% of the sum total would be doctorate holders graduating in the States. Although data from Europe is unavailable, by taking into account the number of postgraduate scholarships granted to follow courses in Europe it can be estimated that Argentinian doctorate holders in science and engineering obtaining their degree abroad cannot be under 40% of the total of doctorate holders who graduate in Argentina. That proportion is likely to decrease if we include other fields of science, excluded from sciences and engineering,

40. As far as the stock of Argentinian doctorate holders residing abroad, NSF data for 1999 reveal that 2,700 Argentinian people holding doctorates in science and engineering reside in the States. Estimates of the stock of doctorate holders living in Argentina are not reliable enough; nevertheless, the figure stated above is quite significant in any case.

Table Nº 5. **Argentinian students obtaining their doctorate degree in science and engineering at the United States, 1993-2002**

1993	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
53	*56*	*49*	*66*	*67*	*70*	*54*	*76*	*69*	*66*

Source: NSF (2004).

2.4. Dynamics of growth and employment career of doctorate holders

41. Up to certain point, the increase of postgraduate studies resulted from that of the stock of university graduates –around 60%–, which ensued the growth of university matriculation beginning in 1984. Besides that, the increase of postgraduate programs is related to wider social and cultural processes: thus, it became part of the policy of university modernization attempted by national universities in the period of transition to democracy. The loss of capabilities in university research and researchers' training had been a main concern of university authorities since the mid eighties, and it led them to take steps to overcome deficiencies and respond to a continuously growing student population. However, they did not choose to follow the steps of Brazil, where in order to improve the quality of teaching delivered to an increasing amount of students, very ambitious scholarship programs were developed.

42. Postgraduate education was also seen as a means to improve employment opportunities. This was one of the main reasons for the increase of masterships, especially in the areas of business and administration. Instead, the growth of matriculation in doctorate programs was impelled mainly by the importance allotted to doctorates for promotion in university teaching careers, especially in the mid nineties.

43. The growth of supply of postgraduate programs cannot be considered solely a response to an actual or potential demand. It is possible that, in many cases, the very dynamics of the growing supply may have created a demand which went beyond expectations. On the basis of this process lay the fact that following postgraduate programs –particularly in the area of social sciences– did not require full-time dedication or, at least, a dedication of an extremely exacting number of hours. This is why postgraduate students are able to follow postgraduate courses and, at the same time, work more than 35 hours a week. As a result of this possibility, graduate programs show very low efficiency; both in terms of students obtaining their degrees and in terms of the time they take to graduate.

44. Doctorate programs differ slightly from this pattern, particularly because the existence of doctorate scholarships enables full-time dedication. However, even in the most consolidated doctorate programs the number of registered students who have not been granted a scholarship or any other kind of financial help is very high. For instance, the postgraduate students census held in 2000 at the University of Buenos Aires shows that 303 out of 691 postgraduate students at the Faculty of Exact and Natural Sciences did not have a scholarship or any other kind of assistance. A high proportion of those students are university teachers, who devote part of their time to fulfill the requirements to obtain their doctorate degree.

45. This trend is relevant when we analyze the employment careers of doctorate holders, since a significant percentage of doctorate holders are already employed while they follow their studies. It is possible to state two main careers in doctorate holders' education. Part of the students –mainly those pertaining to exact and natural sciences– follow their doctorate studies with the help of scholarships –granted by CONICET or by the universities–, with full-time dedication, within laboratories and consolidated research teams. They begin their doctorate studies short time after finishing their undergraduate courses

and they are likely to graduate when they are around thirty years old. After graduating, they usually work at some research institute pertaining to CONICET or to a national university.

46. The rest of the students make a more heterogeneous group: it includes university teachers or employees, especially in public administration, who are able to devote less time to doctorate studies, and whose relationship to laboratories and research teams varies according to their teaching position, both in terms of dedication and rank. Indeed, within this group there are more students who drop their studies, they take more time to graduate, and do so at an older age. The doctorate degree is likely to operate as a means to consolidate their working position or to make progresses along their university career.

47. We have an appropriate indicator to check the existence of this trend at the University of Buenos Aires. Out of 8,809 postgraduate students registered by the 2000 census, 3,806 –namely 43%– had finished their undergraduate studies before 1993, and, within this group, 2,730 –30%– had done so before 1990. Besides, the proportion of students who had graduated before 1990 was significantly smaller at the Faculty of Exact and Natural Sciences, and greater at the Faculty of Humanities, where the pattern of teachers who follow their doctorate studies after obtaining a teacher position is much more frequent.

3. Doctorate holders' employment

48. We have very little information about employment of doctorate holders. National censuses have not asked questions about doctorates, and the number of doctorate holders is too slow to be caught by households' permanent surveys. National surveys about firms' technological behavior do not register postgraduate education either. Therefore, information about doctorate holders' employment in private enterprises is fragmentary and anecdotic. Similar limitations of information are encountered regarding doctorate holders' type of activity and salaries. This stated, some general trends on features of the professionals' type of activity and salaries, and some specific ones about labor relations and salaries within public universities can be outlined.

49. To be able to understand some aspects of doctorate holders' employment careers, we will start by briefly presenting some trends in university professionals' employment during the last decade, and employment patterns of the main jobs obtained by doctorate holders.

3.1. Information about university professionals' activity status and salaries

50. One of the main features of Argentinian social situation along the last ten years was the increase of unemployment rates, which has practically tripled since the beginning of the nineties. This trend has been even stronger among university professionals. Focusing Great Buenos Aires –the main urban concentration in the country and the main place of residence and work for professionals–, the trends were as follows:

Table 6. **Unemployment rates, total and with 13 years of education and over, Great Buenos Aires, 1990, 1994, 1997, 1999 and 2002**

	1990	1994	1997	1999	2002
Total	5.9	13	14.3	14.7	19
13 years of education and over	...	7.7	9.4	10.2	14.3

Source: CEPAL, 2004.

51. This increase of unemployment has contributed to the stagnation or reduction of the income gap between workers with university qualifications and the rest, particularly among 25 to 34-year-olds. In other

words, the relative price of professionals' work compared to other groups is significantly lower than in other countries within the area, while actual salaries diminish.

Table 7. **Argentina: Differences on salaries related to educational attainment, 25 to 34-year-old population, by sex and level of education attained, 1993-1999 (higher secondary level index =100)**

Higher education level attained		1994	1999
Below higher secondary level	Male	72	71
	Female	69	63
Higher secondary level	Male	100	100
	Female	100	100
Tertiary non university	Male	98	131
	Female	96	137
University	Male	164	177
	Female	208	168

Source: Carlson, 2002.

52. The registered data depict a situation where getting a job is becoming more and more difficult, and where university qualifications do not guarantee an advantage in terms of employment or income neither similar to previous periods in Argentinian history nor equivalent to other Latin American countries.

3.2. Employment in public universities

3.2.1. Number of doctorate holders in public research institutions

53. As for public institutions, we have information about the employment of doctorate holders in university research and as researchers at CONICET. We estimate around 7,000 the number of doctorate holders who were employed in 2000 at academic research institutions. Instead, we lack reliable estimates about doctorate holders employed in mission-oriented science and technology institutions –basically, CNEA (Comisión Nacional de Energía Atómica / Atomic Energy National Commission) and INTA (Instituto Nacional de Tecnología Agropecuaria / Agricultural Technology National Institute). INTA and CNEA employ little more than 1,900 researchers. Even assuming a high percentage of doctorate holders among those researchers –let us say 30%–, the total number of doctorate holders within the whole of the researchers would be around 8,000. That number of doctorate holders would be 19% of the researchers in the country considered as individuals, and 28% if we consider an equivalence to full-time dedication. According to the teachers' census held by University of Buenos Aires, a significant number of doctorate holders at that institution –around 1,100– are not included in the Programa de Incentivos para los Docentes Investigadores (Program of Incentives for Researcher Teachers), mainly concentrated in the areas of Medical Studies and Law. Although a similar pattern cannot be established for the rest of national universities, other universities with similarly important Medical Studies and Law departments might employ a group a doctorate holders with similar characteristics.

54. If we focus the research performed in national universities, the sum total of doctorate holders registered in Program of Encouragement for Researcher Teachers at National Universities was 3,095 in

2000. This figure stood barely for 16% of the members of that program, and nearly 3.6% of the whole of university teachers. These percentages are extremely low.

55. Among university researchers, doctorate holders' distribution by fields of science was as follows:

Table 8. **Doctorate holder researchers registered in Program of Incentives for Researcher Teachers at National Universities, by fields of science, 2000**

Fields of science	**Total**	**Percentage**
Natural and Exact Sciences	2,092	68%
Engineering and Technology	155	5%
Medical Sciences	211	7%
Agricultural Sciences	115	4%
Social Sciences	258	8%
Humanities	264	8%
Total	**3, 095**	100%

Source: PIDIUN (2000).

56. The number of doctorate holders employed by CONICET is 3,351, which means 85% of the whole of researchers of that institution. Near two thirds of CONICET's researchers work at university institutes and take part in the Program of Incentives.

Table 9. **Researchers at Conicet, doctorate holders and non-doctorate holders, by category, 2002**

Category	**Doctorate holders**	**Non-doctorate holders**	**Total**
Assistant	505	64	**569**
Associate	1,326	210	**1,536**
Independent	942	164	**1,106**
Principal	433	44	**477**
Higher	145	9	**154**
Total	**3,351**	**491**	**3,842**

3.2.2. Academic career and income

57. Since most doctorate holders work at public universities, it will be useful to register some general features about their academic career, labor relations and income.

58. National universities had, in 2000, a staff of 109,484 positions, which does not mean an equivalent number of people. As for private universities, they concentrate 17,754 positions, less than 15% of the sum total. The main structure of academic positions and time dedication is summarized in the following table:

Table 10. **Teaching categories**

Professors	Full Professor
	Associate Professor
	Assistant Professor
Junior Teaching Staff	Senior Assistant
	Assistant
	Teaching Assistant (Volunteer advanced students)

59. Time dedication is classified in three categories:

- Full time dedication, which requires around 40 hours of labor per week.
- Half exclusive dedication, requiring around 20 hours of labor per week.
- Part time dedication, requiring around 10 hours of labor per week.

60. Teachers fulfilling full time or half exclusive dedications are required to do research.

61. The following table shows the proportional distribution of these positions, according to teaching categories and dedications:

Table 11. **Distribution of positions, according to categories and dedication, national universities, in percentage, 2000**

	Full time	***Half exclusive***	***Part time***	***Total***
Professors	*8.6*	*10.8*	*20.4*	*39.8*
Junior teaching staff	*5.6*	*12.8*	*41.8*	*60.2*
Total	*14.2*	*23.6*	*62.2*	*100*

Source: elaboration of our own after data from Anuario de Estadísticas Universitarias 1999-2000.

62. As the figures enable us to observe, university teaching has low professional commitment: only a small proportion of teachers –concentrated in some areas– have full time dedication. This low professional commitment is related to a highly non-regulated system of labor relations.

63. Regulations for public university education in Argentina –mainly, Law of Higher Education and universities' statutes– establish the conditions required to be admitted to and perform university teaching, through mechanisms of public competitions based on backgrounds and opposition, which enable the winner to obtain a stable position. Notwithstanding, legal regulations have a limited range and prevailing practices not always fit to prescriptions. Regular teachers (stable tenure-like status) do not exceed 50% of the teaching staff in many national universities. In the case of junior teaching staff, the proportion of regular teachers is even smaller. The rest of the teachers are temporary: they are hired yearly. However, they enjoy a de facto stability, which means an automatic renewal of their contracts, with very few exceptions.

64. As for postgraduate courses are concerned, types of hiring are even more precarious –for instance, they are hired by the hour. Although full time teachers are not supposed to receive an additional salary for the postgraduate courses they may give, in most cases giving postgraduate courses means an additional income.

65. This lack of regulation in the hiring and control systems is related to two kinds of phenomena: low salaries and multi–employment. In national universities, teaching categories are organized through a fixed salary scheme, where the only item which makes differences within each category are years of service. The difference between the lowest and the highest academic positions is very small –between 1.5 and 1.7. Salaries are low, particularly in part time dedications, which mean less than U$S 1,000 per year. The salary for full time positions is about 8 to 10 times the part time one. Program of Encouragement for Researcher Teachers at National Universities enables an increase in those teachers' income in various proportions, according to categories and dedications.

66. The counterpart of these low salary levels is the lack of control over the effective fulfilling of the requirements demanded from teachers, especially full-time ones. Many teachers enjoy positions in different national universities, other public or private educational institutions, other public institutions or –the least– private enterprises, whose requirements in terms of working time are mutually incompatible.

4. Some comments on the survey project

67. The following comments attempt to identify some issues and problems deriving from the trends we have mentioned, which affect the possibility of conducting a survey on the careers of new doctorate holders that might be, at the same time, useful for Argentinian science and technology policies and whose results enable international comparisons.

68. From our point of view, the key issue that should be emphasized is the discrepancy in the trends regarding doctorate holders' education and employment between Argentina and OECD countries, and the problems of public policy which result from those trends. As Isabelle Recotillet's report clearly states, "the marked tendency in industrialized countries for doctorate recipients to move into the private sector (in certain scientific disciplines such as engineering sciences) poses the problem for public research systems of recruiting new staff for public research organizations, against the background of a graying scientific population".

69. This statement could probably be moderated or corrected for specific national cases within OECD, but in the case of Argentina, the problem is totally opposed. Private enterprises do not have an active recruiting policy of young doctorate holders, which could reach a significant proportion of newly graduated. Public institutions –particularly CONICET and universities– are almost exclusively the places where doctorate holders in science and engineering work. There fore, there is no dispute between private enterprises and public institutions for the new doctorate holders, and the main problem is the weak demand of highly skilled personnel registered among private enterprises. These statements are likely to become more clarified and accurate after the survey is conducted.

70. This prevailing or almost exclusive role of the public institutions as working place for doctorate holders brings about some additional problems. The first one, which has a general scope, is related to the impact of political and economic instability, and of policies oriented to reduce public expenditure. Although, in every country, fluctuations in the economic cycle condition changes in the labor market which affect doctorate holders, Argentinian recent experience slips out of the parameters prevailing in OECD countries. In the last fifteen years, Argentina has experienced two processes of hyperinflation and two serious economic crises. As a result of the first crisis, the unemployment rate increased almost to 20%; the last one meant a Gross National Income fall of around 20%. All these situations struck public finances

directly and implied strong public expenses reductions, which affected both actual salaries and employment. Among the first steps recurrently taken were the freezing of vacancies and the interruption of admissions and promotions within careers. Therefore, the possibilities of employment, salaries and careers for doctorate holders was strongly reduced by the drastic responses of national authorities to the various periods of crises and growth.

71. Besides these general conditionings, there have been and there still are more specific institutional patterns which have enabled different institutions within the Argentinian scientific and technological system to mitigate the impact of the crises or to take advantage of the favorable financial situations. In terms of human resources, there neither has been nor there is a common policy for the whole of the national public administration. This means that some institutions –such as the INTA or the CNEA– have hired no new employees from 1990 to 1999, whereas other ones have admitted, from time to time, new personnel.

72. As we have previously stated, yearly graduation of doctorate holders in Argentina is very low. This fact brings about some problems for the survey conducting, since in many areas the number of graduates is very small, and the samples or the response rates may affect the reliability of the results.

73. Briefly, we can state that the universe of our analysis is a small group of doctorate holders, whose main nucleus of education is University of Buenos Aires whereas small doctorate holders' producers are spread in the rest of the country, who have two main employers –national universities and national institutions in science and technology, especially CONICET– following non-directed human resources policies, conditioned by the fiscal impact of the abrupt fluctuations of the economic cycle characteristic of Argentinian recent history. The combination of both trends leads us to adopt a wider time horizon than the usual one in the surveys reviewed by Recotillet.

74. To be more precise, in the Argentinian case we consider it convenient to study the group of doctorate holders who have obtained their degree in the last ten years, which means a sum total of 3,500 to 4,000 doctorate holders. The choice of a greater number and a wider time horizon will enable us to avoid strongly marked biases resulting from the economic or financial short-term situation, or from the scarce number of doctorate holders in most fields of science.

BIBLIOGRAPHY

Albornoz, Mario, Luchilo, Lucas, Raffo, Julio y Barrere, Rodolfo, *El talento que se pierde. Aproximación al estudio de la emigración de profesionales, investigadores y tecnólogos argentinos*, Centro Redes, Documento de trabajo N° 4, 2002, http://www.centroredes.org.ar/documentos/files/Doc.Nro4.pdf

Barsky, Osvaldo, *Los posgrados universitarios en la Argentina*, Buenos Aires, Editorial Huemul, 1997

Barsky, Osvaldo "El desarrollo de las carreras de posgrado" SPU, MECyT, Argentina, 1999

Carlson, Beverley "Educación y mercado del trabajo en América Latina", En Revista de la CEPAL, Santiago de Chile, CEPAL, N°77, 2002, p.123-141

Comisión Económica para América Latina y el Caribe, *Panorama social de América Latina y el Caribe*, Santiago de Chile, CEPAL, 2004

Fanelli, Ana M. García de *Academic employment structures in higher education: The Argentine case and the academic profession in Latin America*, Geneva, ILO-UNESCO, 2003

Guerrini, V; Jeppesen "El sistema de posgrado en Argentina: problemas y desafíos de los procesos de acreditación en el marco de las políticas para el mejoramiento de la calidad del sistema de educación superior" Revista Escenarios Alternativos, agosto 2001.

Jeppesen, Cynthia; Nelson, Alejandra; Guerrini, Victoria, *Diagnóstico y perspectiva de los estudios de posgrado en la Argentina*, IESALC-UNESCO, 2004

Ministerio de Educación, Ciencia y Tecnología. *Anuarios estadísticos sobre educación superior, varios años.*

Luchilo, Lucas "Formación de recursos humanos" en RICYT (Red de Indicadores de Ciencia y Tecnología Iberoamericana) *El Estado de la Ciencia. Principales Indicadores de Ciencia y Tecnología 2002*, Argentina, 2003.

Ministerio de Educación, Ciencia y Tecnología, Estadísticas de posgrado, 1997

Ministerio de Educación, Ciencia y Tecnología, Información estadística de la Secretaría de Ciencia y Tecnología.

Ministerio de Educación Ciencia y Tecnología *Informe final de la Comisión Nacional para el Mejoramiento de la Educación Superior*, mimeo, Buenos Aires, 2002

National Science Board, *Science and Engineering Indicators 2004*, Arlington, NSF, 2004

Recotillet, Isabelle Availability and characteristics of surveys on the destination of doctorate recipients in OECD countries*, OECD, STI Working Paper 2003/9*

Universidad de Buenos Aires, Censo de estudiantes 2000

Universidad de Buenos Aires, Censo de docentes 2000