MEXICO, COLOMBIA, AND VENEZUELA

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MEXICO

RECENT REFORMS AND TRENDS

In 1987, the National Council for Science and Technology (CONACYT) started a support program in Mexico for graduate courses that required all graduate programs to provide data about their current state, curricula, enrollment, graduates, teaching staff, etc. In addition, members of an ad hoc evaluation committee visited each program. Although only a limited number of programs responded to this initiative at first, public universities, together with educational authorities, did make an effort to increase the number of responding graduate programs; 8 years later, CONACYT had accredited 614 graduate programs. By 1996, however, this number had dropped substantially from 614 to 478 accredited graduate programs. This drop may be explained in terms of a change in the evaluation criteria recently applied by CONACYT and to the disappearance of the "others" category. With some ups and downs, a group of 160 doctoral programs (33.5 percent of the accredited graduate programs) has been established that competes with some high-level doctorates abroad. However, only a small number of domestic doctoral programs have achieved such a level of quality. Among the doctoral programs, 18.8 percent are in the basic sciences, and 16.9 percent are in engineering.

Table 1. Mexican graduate population by field of study, 1991-96

Field	1991	1992	1993	1994	1995	1996
Total	425	453	461	574	614	478
Basic sciences	46	52	55	64	74	68
Natural sciences	32	36	31	36	36	29
Health	34	41	43	51	52	35
Earth sciences	20	19	17	18	20	18
Social sciences	52	59	70	95	107	103
Human & behavioral sciences	51	52	48	67	69	45
Applied & engineering sciences	109	103	102	131	135	97
Biological applied sciences	81	91	95	112	121	83

SOURCE: National Council for Science and Technology (CONACYT) <<http://www.main.conacyt.mx1/>>, 1998.

In the Government Program of Science and Technology (Programa de Gobierno de Ciencia y Tecnología 1995-2000), the training of human resource professionals was given priority, due to the insufficient quantity and quality of those already in the workforce. It was agreed to support more strongly high-quality doctoral programs offered by Mexican institutions through evaluation by groups of prestigious academics and better fellowships to the students enrolled in these programs, and by establishing a postdoctoral fellowship program for those graduating from such programs. As a result of continuous effort, graduate enrollment grew 129.48 percent between 1987 and 1997, to a total of 87,696 students. Adding to this figure those who were abroad (data available for 1995-96 indicate that there were 3,360 Mexican graduate students abroad) yields a total global graduate population of over 91,000. It is estimated that postgraduates represent slightly over 1 percent of those new employees who join the workforce each year.

Many a graduate program, even within the same institution, tends more to disintegration than to union, collaboration, and collective effort; moreover, they are often centered in groups that are not highly productive, as reflected in times to degree completion. Perhaps the most disturbing feature is the scant number of students with few instructors in some fields. The small number of graduates produced in the different fields therefore comes as no surprise; this in turn results in very low growth of research scientists and engineers.

A frequent complaint is the lack of connection between *licenciatura* and graduate programs, and between teaching and research programs. Often, an institution hires researchers with the aim of strengthening its teaching through lecture-giving, rather than making it a requisite part of the program that students spend a work period in a research group. The old system of laboratory practices is frequently preferred, although some universities have very well-furbished research labs, and excellent students could undoubtedly be oriented toward the graduate level and research.

Table 2. Number of graduate programs accredited by field of knowledge in Mexico, 1991-97

Field	1991	1992	1993	1994	1995	1996-97
Total	425	453	463	574	614	NA
Doctorate	118	120	129	172	195	160
Basic sciences	25	30	30	35	41	38
Natural sciences	21	23	18	19	19	15
Health	21	26	28	33	31	21
Earth sciences	11	11	10	11	12	10
Social sciences	43	49	59	73	81	77
Human and behavioral sciences	32	37	32	45	46	29
Applied and engineering sciences	84	78	77	96	98	70
Biological applied sciences	60	69	70	82	84	58
Master's	297	323	324	394	412	318
Basic sciences	25	30	30	35	41	38
Natural sciences	21	23	18	19	19	15
Health	21	26	28	33	31	21
Earth sciences	11	11	10	11	12	10
Social sciences	43	49	59	73	81	77
Human and behavioral sciences	32	37	32	45	46	29
Applied and engineering sciences	84	78	77	96	98	70
Biological applied sciences	60	69	70	82	84	58
Others	10	10	10	8	7	NA
Basic sciences	3	3	2	2	2	NA
Natural sciences	0	1	1	1	0	NA
Health	0	0	0	0	0	NA
Earth sciences	1	0	0	0	0	NA
Social sciences	1	2	2	2	2	NA
Human and behavioral sciences	10	0	0	0	0	NA
Applied and engineering sciences	4	3	3	3	3	NA
Biological applied sciences	1	1	1	0	0	NA

SOURCE: National Council for Science and Technology (CONACYT) <<http://www.main.conacyt.mx1/>>, 1998.

The government's policy aims with regard to training high-level scientists and engineers include the following:

- to increase the number of fellowships for graduate studies in Mexico and abroad;
- to support training programs for the *licenciaturas* teaching staff;
- to foster increased offerings of good-quality *licenciaturas*;
- to accelerate improved quality in domestic graduate programs—particularly, to stimulate the establishment and accreditation of high-level doctoral degrees comparable to those available internationally in the coming years; and
- to promote improved professional training in the sciences and engineering.

Levels of Graduate Enrollment and Degrees in Mexico

Enrollment. The development of higher education in Mexico is necessary to support research and improve the training of teaching staff within higher education itself, as well as influencing the remaining levels and subsystems of education. At the present time, most higher education teachers (about 80 percent) have only a first degree (*licenciatura*), and the number of researchers in this country of 90 million is less than 10,000. If the figures of the National System of Researchers (SNI) are taken as a reliable indicator, the development of the scientific

endeavor in Mexico—particularly in connection with training the future generation of scientists—rests upon a little over 5,000 people in SNI levels I, II, and III (1997).

As far as graduate education is concerned, enrollment is very low (87,696) relative to the *licenciatura* (1,310,229) and normal education[1] (188,353) programs; it represents only 5.85 percent of total higher education enrollment in Mexico—thus indicating the need to give priority to the growth of graduate education. Note, however, that graduate enrollment has more than doubled in the last 10 years, rising from about 38,200 in 1987 to about 87,700 in 1997. (See appendix table 1.)

Although the proportion of students seeking education in science and technology in Mexico is not significantly different from that of more industrialized countries, the schooling rate of the age group is lower, because the latter students have more extensive nonuniversity sectors that provide shorter training of a more practical and vocational nature—i.e., more students have a nonuniversity education adequate to meet the conditions of the employment market. Qualified observers of the Mexican educational system notice a weak enrollment in training for work and terminal secondary higher education,[2] which on the whole comprises barely 3 percent and has lost its attractiveness since the 1980s (OECD 1997, p. 38). The modalities of what in many countries is called post-obligatory secondary education and in Mexico is known as *formación media superior*, its content, and its structure help explain to a large extent the evolution of the demand for higher education. It is also at that level that many countries offer broad possibilities for technical and professional training. It is for this reason that Organisation for Economic Co-operation and Development (OECD) examiners called attention to the need for observing the extent to which these training programs coincide with those of higher education. In Mexico, this educational level has traditionally had a preparatory function: many educational institutions depend directly upon higher education institutions. It thus seems advisable, when trying to get an overview of higher education and the role of graduate education, not to disregard the complex structure and interlocking levels and subsystems.

Higher education in Mexico has a long history. It has managed to educate an internationally recognized intellectual and professional elite, but the mean level of education and professional qualification continues to be very modest. The organizational framework within which the Mexican system of higher education fulfills its function is through the following programs and levels of study: (1) the *licenciatura* level, traditionally associated with professional training; and (2) graduate studies, specifically specialization certificates and master's and doctoral degrees. To complete a *licenciatura* takes from 4 to 6 years; specializations take 1 year, except for medical options; master's programs, 2 years after *licenciatura*; and doctoral studies from 2 to 3 years after the master's degree or from 4 to 5 years after the *licenciatura*. However, the *licenciatura* or first degree often takes a considerably longer period to be completed.

As far as the public sector is concerned, these levels of study operate in a very complex political and administrative setting of institutions of higher education dependent on the federal and state governments. These, in some cases, have to deal with the Secretariat of Public Education (SEP); in others, with the Secretary of Finance and Public Credit; and in still others, with the presidency.

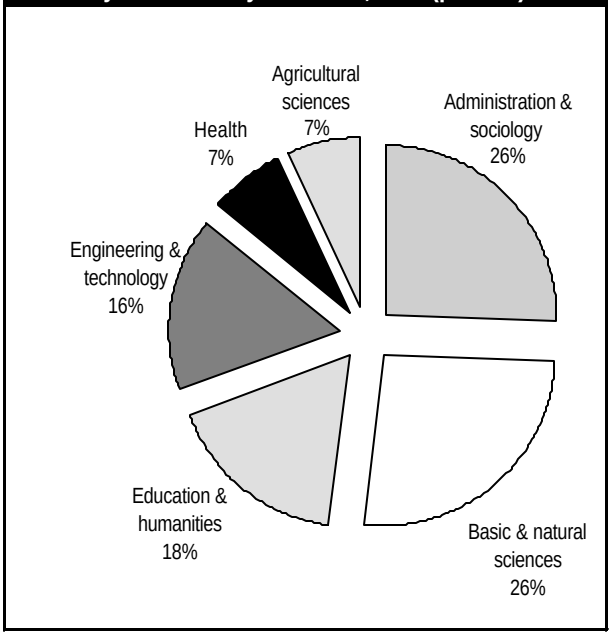
Enrollment in Doctoral Programs. Growth at the doctoral level has been remarkable in relative terms, with a 342.85 percent rise in the 10-year period under consideration. During that same time, the master's level grew 151.68 percent, and the specialist's degree level had an increase of 66.15 percent. But the participation of the population in doctoral programs continues to be minimal (rising only from 1,400 to 6,200 in 10 years) relative to that in master's programs, which still have the bulk of enrollment with 59,900 students, and specialist programs, with 21,600. At the doctoral level, the distribution of enrollment by field is relatively homogeneous: 26 percent corresponds to the basic and natural sciences, 7 percent to health and applied biological sciences, 26 percent to social and administrative sciences, 18 percent to education and humanities, and 16 percent to engineering and technology. But only two disciplines had more than 500 students enrolled: biology (522) and education (668) in

[1]Normal education, which involves the training of basic education teachers in normal schools, is included here with higher education, because the degree granted since 1984 is that of *licenciatura*. However, normal education has its own identity in terms of curriculum, organization, and ideology.

[2]Secondary education lasts 3 years and is offered to the 12- to 16-year-old population that has completed primary school. It is provided in the following modalities: (1) *general secondary*, which accounts for the largest proportion of enrollment; (2*) technical secondary*, which simultaneously provides general education and terminal training for productive activities in four fields: industry, agriculture, fishing, and forestry; (3) *secondary for workers*, which is given at special times and sometimes in the workplace; and (4) *telesecondary*, created to give opportunity to inhabitants of small and isolated communities.

1997; physics followed with 413, social science with 342, chemistry with 291, agronomy with 270, and anthropology and archaeology with 246. All other fields had meager populations of fewer than 100 students.

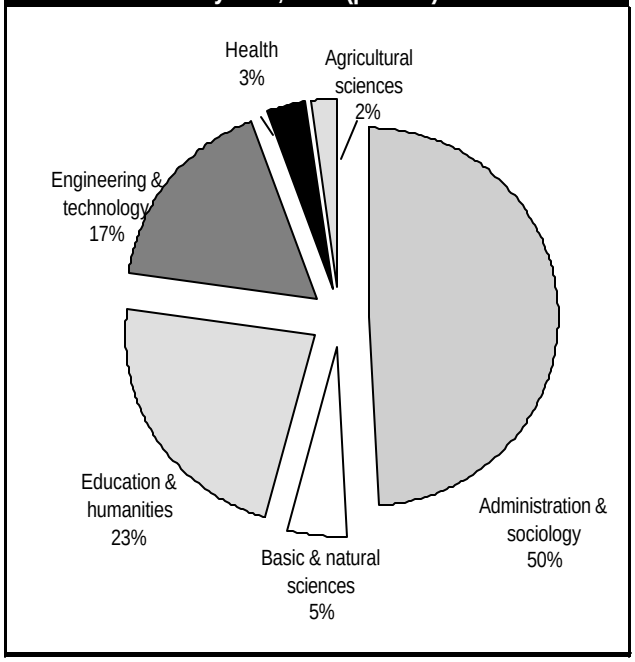
Figure 1. Doctorate student population by field of study in Mexico, 1997 (percent)



SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). Anuario Estadístico, 1997.

ogy, which had 16,923 students in 1997; followed by education (10,455) and law (2,851); taxes and finances (2,425); psychology (2,248); and economy and development (2,104).

Figure 2. Master's student population in Mexico by field, 1997 (percent)



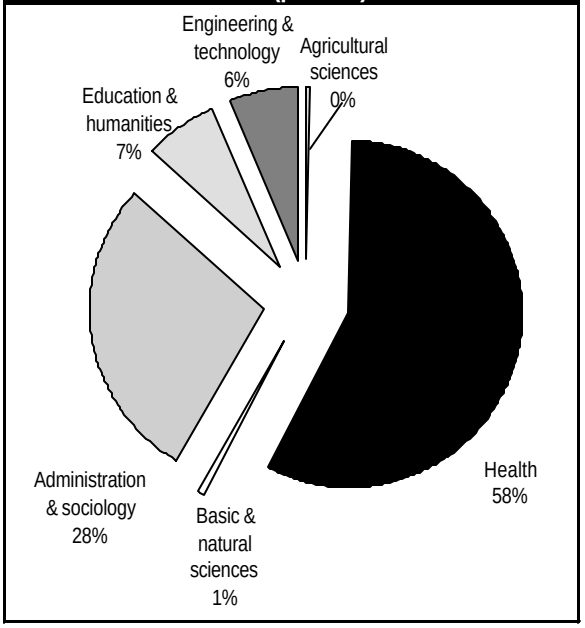
SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). Anuario Estadístico, 1997.

Accepting the premise that the doctorate is the best means to train researchers and advanced teachers, the small number of Mexican doctoral students both in the country and abroad is clearly a limiting factor for the country. When looking at potential supply and demand given the number of researchers in the SNI (5,000, excluding candidates), with good planning, a greater number of graduate students could attend than is the case at the present time; this would raise the current figure by a factor of three. Also, there are enough candidates who could enroll in doctoral programs—i.e., students newly graduated from master's programs—as well as teaching staff who do not yet have a doctoral degree.

At the master's level, enrollment is dominated by the social and administrative sciences, keeping the same proportion as at the *licenciatura* level: i.e., approximately half the total enrollment. There follow in importance education and the humanities with 23 percent, engineering and technology with 17 percent, and the basic and natural sciences with 5 percent. The remaining fields (health and agricultural sciences and technologies) have marginal enrollments of 2 or 3 percent each. By far the most impressive concentration is in anthropology and archaeol-

Specialization studies are graduate studies carried out after the *licenciatura* which prepare students for work in a specific field of professional endeavor without constituting an academic degree. In 1997, 21,600 students were enrolled in specialization programs, or 24.62 percent of total graduate enrollment. At the specialist level, most of the enrollment has historically been concentrated in the health sciences, due to the fact that medicine and dentistry professional specializations are obtained through this means. However, the proportion of enrollment captured by the health sciences and technologies at this level has been decreasing. In 1985, it represented 80 percent of total enrollment, compared to less than 70 percent in 1992; by 1997, only 57.3 percent of the total population was at this level. This phenomenon may be explained by the proliferation of specialist programs (generally diploma courses) in the social and administrative sciences, in which absolute enrollment had a threefold increase during the period of reference; and, to a lesser extent, by the growth of certificates in education and in engineering and technology. In the remaining fields, enrollment has also shown an upward trend, although with less intensity.

Figure 3. National concentration of specialties: student population by field and program in Mexico, 1997 (percent)



SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). Anuario Estadístico, 1997.

The SEP has made a real effort to decentralize higher education. Whereas in 1970, over half the enrollment in higher education was located in the Federal District (D.F.), today this zone has only a fifth of national enrollment. There continues, however, to be a significant concentration in the territorial distribution of graduate enrollment. In 1985, over half the enrollment was concentrated in the universities located in the capital city; by 1997, the D.F. continued to have over 41 percent of total graduate enrollment, although a significant effort at decentralization was also noticeable. In 1985, three states still lacked master's programs (Aguascalientes, Chiapas, and Quintana Roo); in 1992, only Quintana Roo was without programs at this level. In that year, however, more than 80 percent of doctorates were awarded to individuals in the D.F.

Along with the territorial distribution is an institutional concentration, which includes outstanding names such as UNAM, which alone has 23.7 percent of all graduate enrollment in the country, as well as the Autonomous Metropolitan University (UAM), the Iberoamerican University, and the National Polytechnic Institute (IPN). Some institutions outside the Metropolitan Zone also have large concentrations of graduate students, particularly at the master's level. Among these are the University of Guadalajara, the University of Nuevo León, and the Technology and Advanced Studies Institute of Monterrey. Finally, there is a concentration of graduate studies and research in the public sector, which accounts for over three-quarters of enrollment, and nearly 87 percent in specialist and doctoral programs.

Table 3. Main geographical concentrations of Mexican graduate student population, 1997

State	Number of enrollments	Number of graduates
Total	87,696	20,203
Specialization	21,625	8,305
Federal District	11,192	3,988
Mexico	1,438	777
Jalisco	1,873	673
Puebla	660	341
Master's	59,913	11,164
Federal District	15,669	3,050
Nuevo Leon	7,169	1,269
Puebla	4,425	815
Mexico	3,934	812
Doctorate	6,158	734
Federal District	3,665	503
Guanajuato	342	35
Mexico	338	36
Jalisco	139	46

SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). *Anuario Estadístico. Poblacic escolar de posgrado.* México, D.F.

Female participation grew very considerably between 1984 and 1996, although males still dominate in some fields. Over this period, female enrollment went up 248.8 percent in master's programs and 325.7 percent in doctoral programs; male enrollment grew 116.1 percent at the master's level and 381.9 percent at the doctoral level—a clear reflection of the great expansion of studies at this level (see appendix tables 2, 3, and 4). In 1997, females accounted for 40 percent of enrollment in master's programs and in 34.42 percent in doctoral programs.

Doctoral Degrees. The number of graduates of doctoral programs has remained very low despite undeniable advances. In 1984, distribution by degree was 3.69 percent doctoral graduates (245 individuals), 54.86 percent master's graduates (3,640), and 41.43 percent graduates of specialist programs (2,749). In 1995, those proportions showed little variation: 2.83 percent doctoral graduates (519 individuals), 54.71 percent master's graduates (10,008), and 42.44 percent graduates of specialist programs (7,764). By 1996, there was a recovery in the

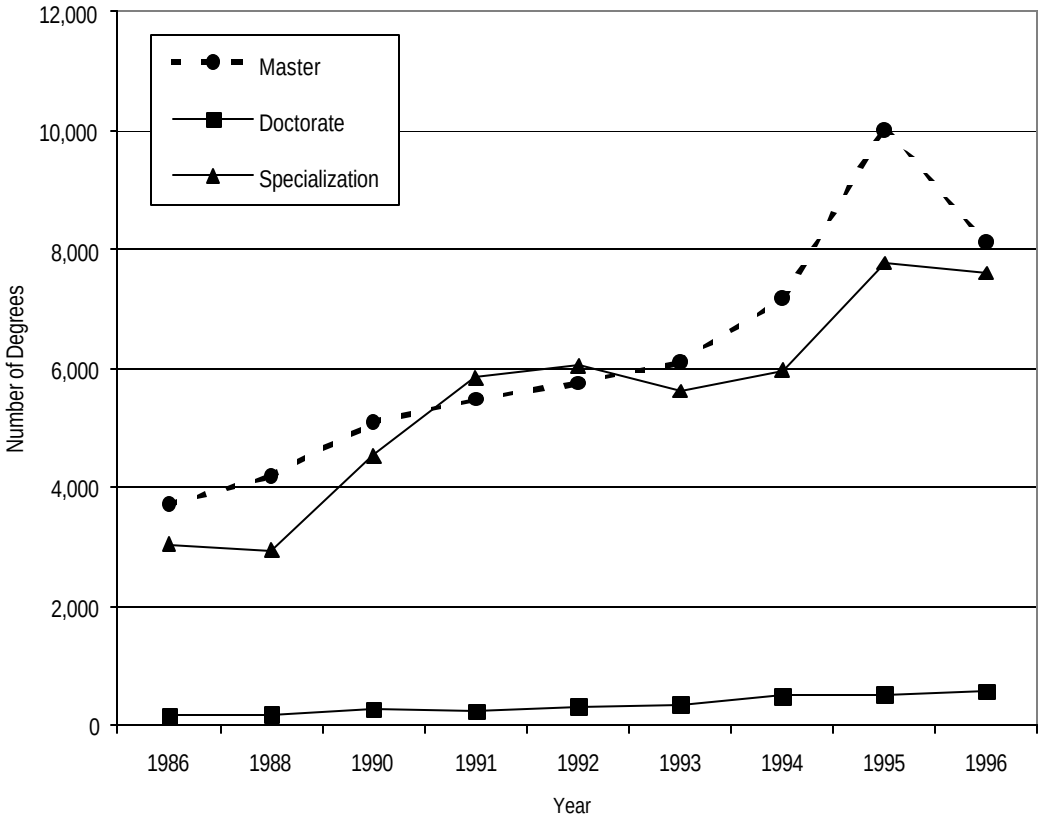
proportion of doctorates relative to the total graduating population, increasing to 3.63 percent (734 doctorates); graduates of master's programs represented 55.25 percent (11,164 persons) and from specialist programs, 41.10 percent (8,305 individuals) (SEP-CONACYT 1997, p. 146, table II.27; and ANUIES 1995 and 1997).

The distribution of doctoral graduates by field in 1996 was as follows: over half (54 percent) corresponded to the social and human sciences combined, 17 percent to the basic and natural sciences, 14 percent to health, 8 percent to engineering and technology, and 7 percent to agricultural sciences and technologies. The most remarkable change is the increment of doctorates in the field of health, showing a 75 percent increase relative to 1995. The agricultural sciences also show a remarkable 140 percent increase in number of doctorate recipients, although the absolute figures are small (48 individuals in 1996).

As far as geographical distribution is concerned, the Federal District continues to show an increasing concentration in the number of graduates produced relative to the rest of the country. In specialist programs, the proportion rose from 19.60 percent of graduates in the D.F. in 1984 to 39.78 percent in 1995. At the doctoral level, compared to 59.59 percent of graduates in the D.F in 1984, there were 64.54 percent in 1995. A reduction is observed only at the master's level: graduates in the D.F. comprised 35.41 percent in 1984 and had decreased to 26.15 percent by 1995. At a university like UNAM, between 1989 and 1996, the granting of degrees at the doctoral level increased 69 percent (329 in 1997), with 31 percent for master's candidates (1,044) the same year. It is intriguing that the data collected for enrollment and degrees, if correct, indicate that those pursuing a doctorate degree in the D.F. are less likely to complete their degree than those pursuing a doctorate outside the D.F. We do not yet have an explanation for this.

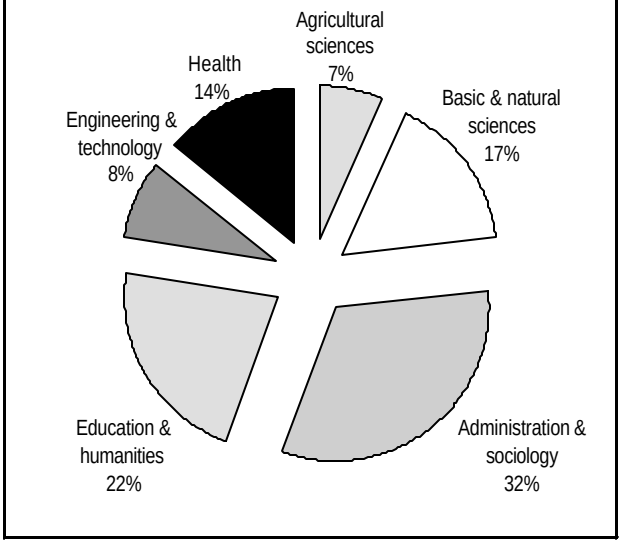
On a cursory level, the number of researchers in some disciplines—such as biology, medicine, and chemistry, with 973, 410, and 317 SNI researchers, respectively in 1997-98—does not seem so scant. Differentiating by subfield, however, reveals significant differences, with some areas showing a potential for improvement and

Figure 4. Graduate degrees earned by Mexican citizens by level of study, 1986-96



SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior ANUIES, Anuarios Estadísticos de Posgrado, 1985-96.

Figure 5. Doctoral graduates in Mexico by field of knowledge, 1996



SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior ANUIES, Anuarios Estadísticos de Posgrado, 1985-96.

growth (e.g., biochemistry and physiology); and others having only a small number of researchers in the local context and thus an apparently small potential for growth (e.g., biophysics among many others). These limitations may affect the future development of new sciences and technologies (Peña 1995, pp.15-18). The same author calls attention in another work (1994, pp. 23-27) to a lack of students, particularly at the doctoral level. He argues that science teaching is one of the weak points in the Mexican educational system, and that one of the mechanisms for attracting the young to research entails integrating them at an early stage in groups that carry out research. Peña urges increased promotion of graduate programs, although he admits that, in the biological fields, there are few places that offer adequate features conducive to fostering research.

Time to Degree. Terminal efficiency—or time to degree—has improved over time. The efficiency of the higher education system is calculated globally, correlating enrollment in a given year with graduation from the institutions 5 years later, which is the average official duration of undergraduate studies (*licenciatura*). Results obtained from the number of graduates in the 1990s give an average efficiency of slightly over 54 percent. This represents an improvement over values observed in the 1970s, when the efficiency proportion hardly reached 45 percent, and over the 1989-90 to 1993-94 period, when it was 49 percent and showed marked variations by course of study.

Improvements seem to have occurred especially at the doctoral level; this is basically attributed to the type of program and support given to graduate students during the period of thesis work. In a field like physics, which has been closely followed by analysts for the last 10 years, it is argued that the terminal efficiency of the graduate programs of the Center for Research and Advanced Studies (CINVESTAV) are the highest in the domestic context. Figures for graduates in physics doctoral programs in Mexico are given in table 4.

Among doctorate recipients from Mexico in the United States, the average time from baccalaureate to Ph.D. is 10.3 years, and the average registered time is 6.5 years; this latter varies between 5.4 years in the computer/information sciences to 6.8 years in the physical sciences and psychology/social sciences. (See appendix table 6.)

Table 4. Graduates from Mexican doctoral programs in physics, 1986-95

Institution	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Average 1992-95 (1981-95)	TE* percent
Total	12	14	21	20	21	27	25	20	30	39	34	-
UNAM	8	7	7	6	8	8	12	4	8	8	8 (8)	38
CINVESTAV	2	2	4	8	3	6	6	6	4	7	6 (5)	86
CICESE	-	2	3	1	4	3	2	3	6	6	4 (3)	
INAOE	-	1	-	-	-	1	1	1	1	4	2 (-)	40
Others	2	2	7	5	6	9	4	6	6	14		

KEY: (-) = not applicable
TE* = Terminal efficiency for the last three generations.

NOTE: Average number of graduate students per institution in 1991-95 and 1986-95 (in parentheses), as well as average terminal efficiency (percentage) for the three more recent generations.

SOURCE: Pérez, A., and V.G. Torrees. La disica mexicana en perspectiva. Interciencia 23(3): 163-75, 1998.

Fellowships. A high-level staff training policy absorbs significant amounts of money (10 percent of the Mexican science and technology domestic expenditure). The growth in recent years of the number of graduate students is largely a consequence of the support given by the federal government to several fellowship programs. In 1990-95, the fellowships granted by these programs increased 190 percent; 24,845 fellowships were awarded in 1995. Several institutions have important fellowship programs, among them the SEP, CONACYT, UNAM, and IPN.

The CONACYT program is the broadest fellowship program in the country. It absorbs almost half the budget resources of the institution (46 percent in 1995) and comprises 65 percent of all fellowships supported by the federal government. In 1996, it supported 18,079 students. Of these, 21 percent were individuals who went abroad to study; the remaining 79 percent studied in Mexican institutions. Of all the fellowships, 12,479 (69 percent) were for master's courses; 5,269 (29 percent) were for doctoral degrees; and 331 (2 percent) supported other studies. This program has grown more than five times in the last 5 years. (See appendix tables 7 and 8).

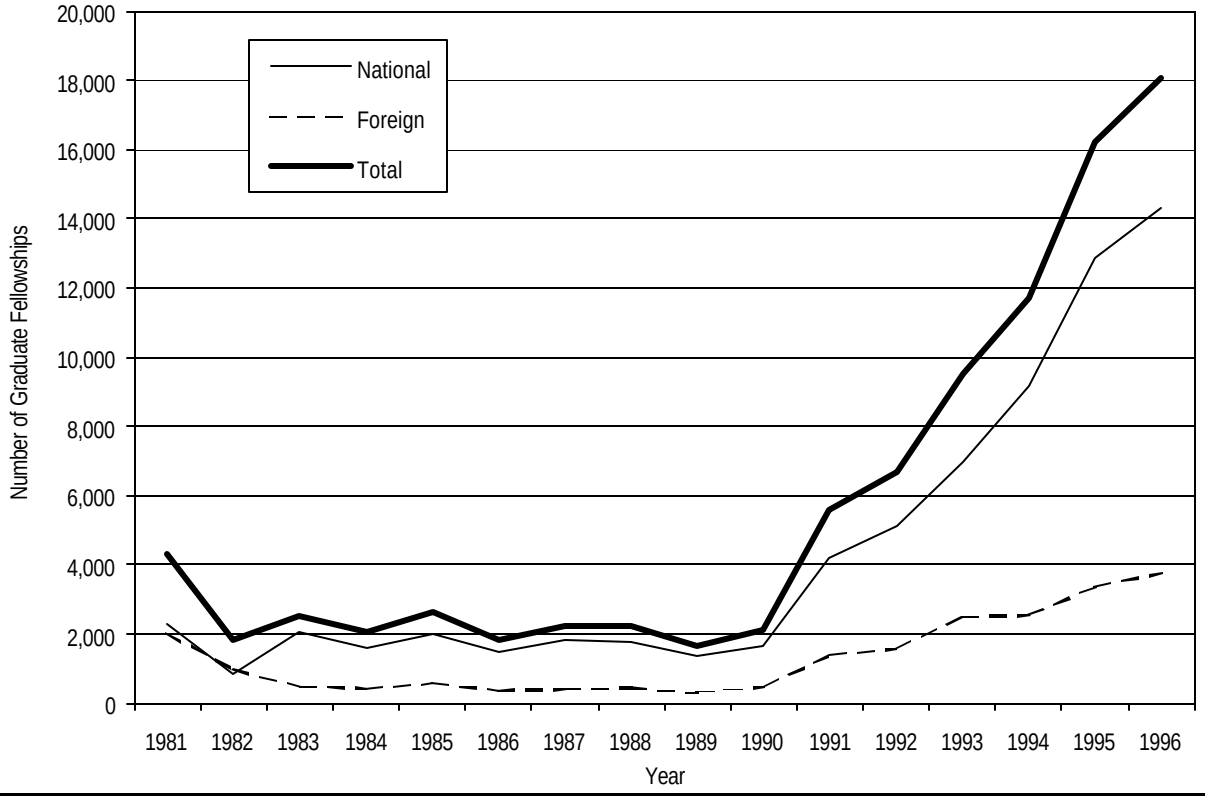
Table 5. Mexican graduate fellowships granted by administrative sector, 1989-95

Sector	1989	1990	1991	1992	1993	1994	1995/p
Total	7,548	8,572	11,900	13,426	16,451	19,057	24,845
SAGAR	-	-	-	-	-	800	1,240
SCT	30	99	159	268	118	6	8
IMT	30	93	155	264	114	0	0
IMC	0	6	4	4	4	6	8
Secofi	-	-	-	-	-	50	61
SEP	4,125	5,401	20,935	20,935	14,351	16,214	21,554
CONACYT 1/	1,677	2,135	5,570	6,665	9,492	11,703	16,200
UNAM	778	1,277	1,417	1,549	1,714	1,494	1,197
Sistema SEP-CONACYT	86	94	147	232	260	564	751
INAH	128	206	297	248	262	n.d	n.d
UAM	90	158	92	91	270	295	350
IPN	1,170	1,344	1,552	1,717	1,860	1,735	2,593
UPN	0	3	1	11	39	NA	NA
Cinvestav	-	-	-	-	-	107	147
DCIT	196	184	422	422	454	316	316
Salud y S.S	-	-	-	-	-	613	760
Semernap	20	24	31	19	19	138	156
Energía	3,358	2,947	2,203	1,959	1,844	402	380
IIE	369	464	466	504	394	273	239
IMP	2,840	2,405	1,588	1,295	1,321	129	141
ININ	149	78	149	160	129	0	0
PGR	15	32	124	145	37	689	538
SHCP	-	69	84	100	82	145	148
Total amount (m.N.P)	41,332	54,106	89,795	155,050	248,098	406,659	676,759

KEY:
p/= preliminary figures
(-)= not applicable
NA= not available
SAGAR= Agriculture, Livestock & Water Resources Secretary
IMT= Mexican Transport Institute
Secofi= Commerce & Industrial Promotion
CONACYT= National Council for Science & Technology
Sistema SEP-CONACYT= SEP-CONACYT Research Centers
INAH= Anthropology & History National Institute
IPN= National Polytechnic Institute
Cinvestav= Research & Directorate of Technological Institutes
m.N.P.= thousands of new pesos
SCT= Transport & Communication
IMC= Mexican Communication Institute
SEP= Secretariat of Public Education
UNAM= National Autonomous University in Mexico
UNAM= Metropolitan Autonomus Univ.
UPN= National Pedagogic University
Salud y S.S.= Health & Social Security
Energía= Energy
IIE= Institute of Electrical Research
ININ= National Institute of Nuclear Research
SHCP= Finance & Public Credit
PGR= Office of the General Attomey of the Republic

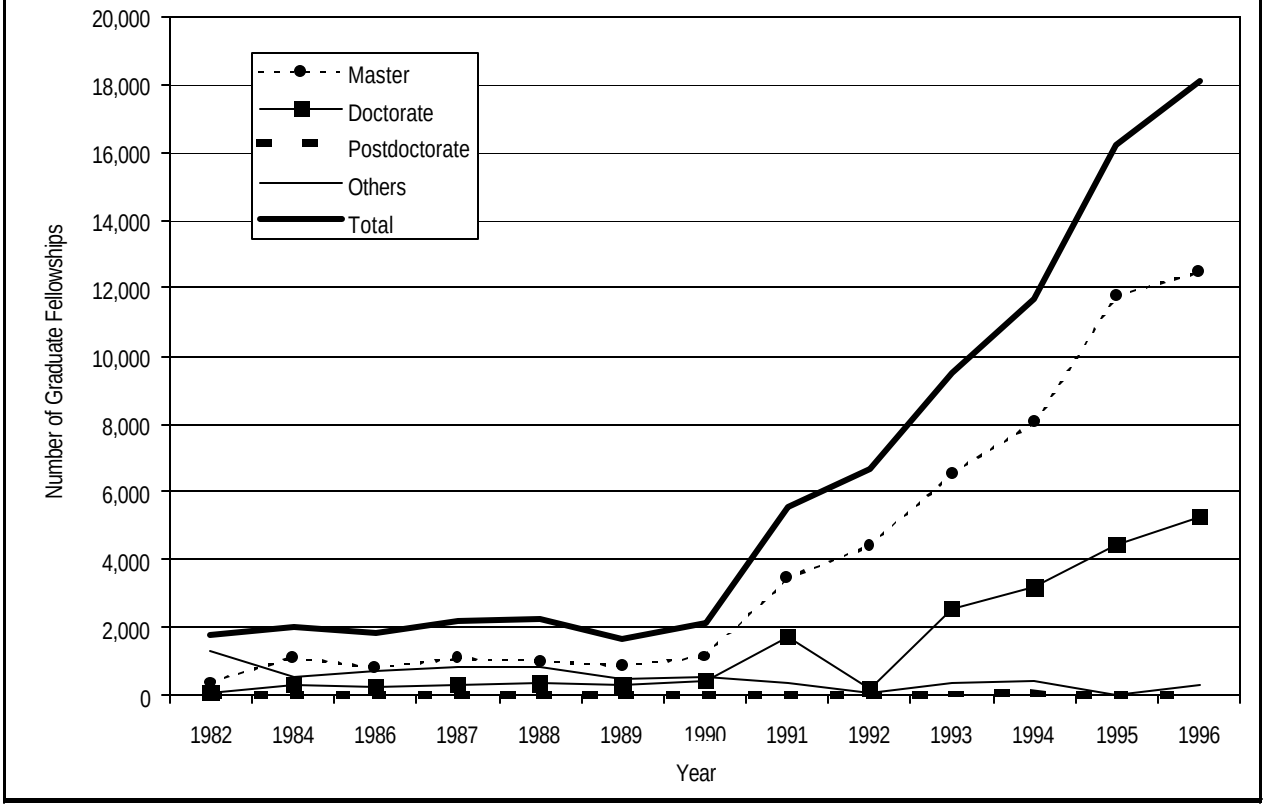
SOURCE: National Council for Science and Technology, (CONACYT) (n.d.).

Figure 6. Mexican graduate fellowships administered by CONACYT, 1981-96.



SOURCE: National Council of Science and Technology Studies (CONACYT), Mexico.

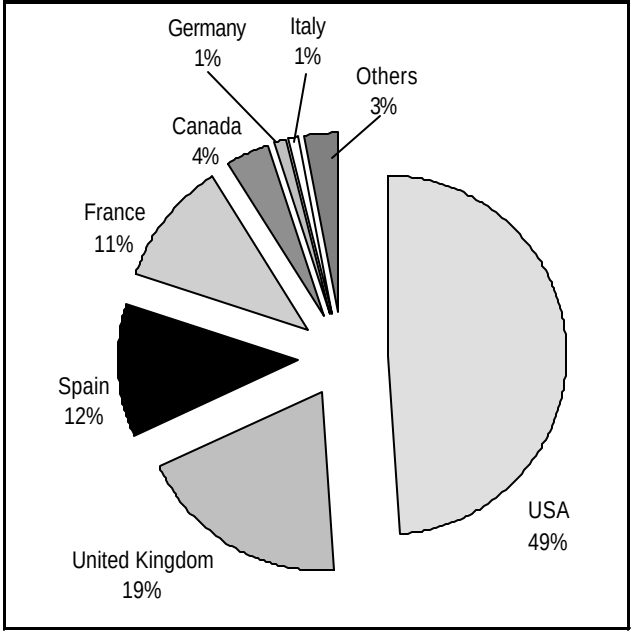
Figure 7. Mexican graduate fellowships administered by CONACYT by study level (1982-96)



SOURCE: National Council of Science and Technology Studies (CONACYT), Mexico.

Of the fellowships abroad, there is a large concentration of students in the United States (49 percent), followed by the United Kingdom (19 percent), and Spain and France (12 and 11 percent, respectively).

Figure 8. Mexican distribution of fellowships abroad by country of destination, 1997 (percent)



SOURCE: National Council for Science and Technology (CONACYT) <<http://www.main.conacyt.mx1/>>, 1998.

When the program was established, the general intention was for CONACYT to recover a major portion of the funds. Thus, support was generally granted in the form of loans. The program was also intended to track its results. Depending on the loan amount, loans may be either all-inclusive or complementary; they also may be for master's or doctoral degrees, or for postdoctoral fellowships. For a variety of reasons, both the recovery of funds and the follow-on tracking of graduates have been deficient. Lack of loan repayments has severely restricted the growth of funds intended for this end; also, given the limited tracking, the results of the support provided are not known for certain. The program should increase its coverage, improve its operational efficiency, and obtain greater social participation in funding. Experience has shown that program expansion depends on institutional capacity to attract outside financial resources.

Data from the National Science Foundation (NSF) on Mexican recipients of doctorates in the United States provides information regarding several aspects of the collective behavior of this population. For example, it indicates that 80.7 percent of this population are males, 65.6 percent are married, and the median age at Ph.D. is 34.5 years. (See appendix table 6.) Almost half of the doctorate recipients (46.9 percent) are supported by their own families, particularly those in non-science and -engineering fields (65.7 percent). The category "personal sources of support" includes a recipient's own earnings, family support, and loans. Another 45 percent are supported by a foreign government, which may be interpreted as the Mexican government (i.e., official Mexican fellowship programs including universities, teaching or research assistantships, etc.). There is no equivalent information for groups of Mexican individuals studying in other countries, but some similarities can be presumed, except that teaching or research assistantships seem to be more common in the United States than elsewhere.

CONACYT has implemented actions to support high-quality doctoral programs in Mexico. For example, in 1996, through the Program for the Strengthening of Domestic Graduate Education, it supported 26 graduate programs in higher education institutions with the aim of enlarging their infrastructure, documenting curriculum portfolios, and/or hiring visiting professors for periods not exceeding 1 year. The main recipients were El Colegio de Mexico and CINVESTAV, which together received 35 percent of all actions approved and were geared mostly to the social and exact sciences. Nevertheless, there are still only a few high-quality graduate programs, and they receive fewer applications for enrollment than ought to be the case: many qualified students who could enroll in them fail to do so, partly because they get better fellowships to study abroad. Solving this kind of problem is important because it would serve as an incentive to improve quality in domestic graduate education.

The degree qualifications of academic staff have been improving, although they are still quite insufficient for both teachers and researchers. It is estimated that only 2.5 percent of *licenciatura* teachers have a doctoral degree, while 56 percent have only a *licenciatura*. In these figures, the considerable weight still exerted by the number of teachers-by-the-hour (the *eventuales*) becomes a heavy institutional ballast, for it is difficult to motivate staff to devote time and effort to professional development when their employment condition is so fragile. There is a trend to increase the proportion of permanent positions (full-time and part-time dedication regimes) to the detriment of those covered by *eventuales* teachers. The current understanding of the problem is that the teacher-by-the-hour is always an interesting figure to have in an institution when hoping to bring closer to the university domain people who have other employment, particularly in industry or the services. Such employees, how-

ever, should always be a small proportion of the total staff; in Mexico, though, they constitute a large proportion (over 60 percent). CONACYT has instituted a special fellowship program since 1991 to stimulate university teaching staff to carry out post-*licenciatura* studies.

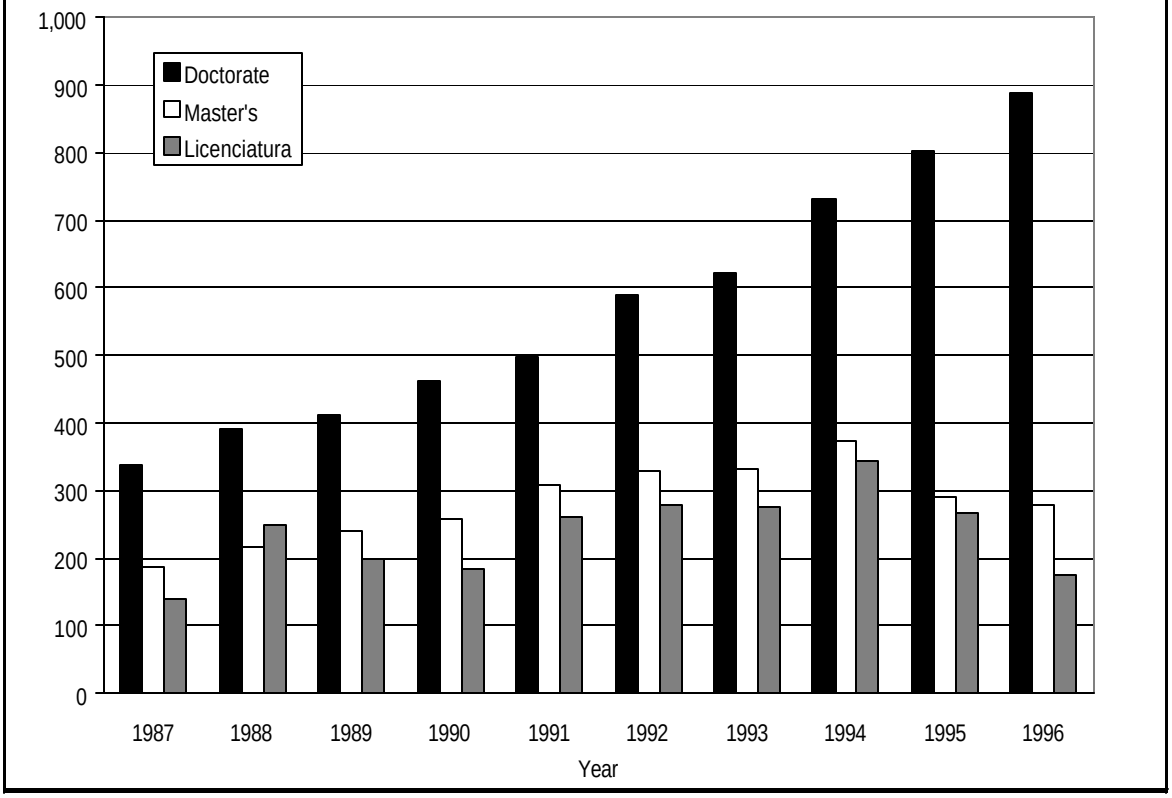
According to an influential viewpoint common in research and development (R&D) circles, new teacher positions should be reserved for persons holding a doctorate or who have a master's degree and are studying in a doctoral program. It is obvious that there is a real and potential demand for master's and doctoral programs. The evolution of teaching and research staff qualifications in the field of physics in Mexican institutions, on which detailed quantitative data are available (figure 9), may be taken to illustrate developments in some fields. But it must also be mentioned that U.S. universities have become more attractive than ever for numerous families who send their children to that country to continue or complete their studies.

International Mobility of Students and Researchers

Although the international relationships of the Mexican scientific community have broadened, especially with the United States and Europe, a good portion of the scientists and technologists are still at the margins of internationalization. Additionally, high-level foreign scientists and technologists do not come to Mexican institutions and research centers for long periods. Mexican students who go abroad to carry out undergraduate and graduate studies represent a modest proportion of total enrollment. In almost all cases, their stay is prolonged. Inversely, the flow of foreign students to Mexican university institutions and research centers is scarce; in general, it is reduced to brief periods.

According to the NSF statistical profile of Mexican doctorate recipients for the 1988-96 period, 1,115 persons were on temporary visas versus 244 on permanent visas

Figure 9. Mexican teaching and research staff in physics, 1987-96



SOURCE: Pérez, A., and V.G. Torrees. La disica mexicana en perspectiva. Interciencia 23(3): 163-75, 1998.

in the United States. Of these, 518 planned to stay longer in the United States, 28.8 percent to carry out postdoctoral studies; another 16.0 percent were seeking postdoctoral study posts, and 33.6 percent were in definite employment or seeking employment (19.5 percent) (appendix table 6).

According to another source (Noguera 1998), Mexico occupies the third place among the countries that export physicians, behind India and the Philippines; it is the first in the world in exports of young physicians less than 35 years old (31.5 percent), followed closely by India (30 percent). Mexico is also first in exporting U.S. physicians newly graduated from Mexican medical faculties who return to their country to carry out well-remunerated medical specialties, after having completed their professional medical studies in Mexico at very low cost. The same source estimates that 7 out of 10 Mexican physicians who are in the United States will stay permanently in that country. Therefore, the effort to repatriate young physicians is not an exclusive responsibility of the government's support programs for scientists.

International mobility is supported by fellowships funded by a number of bilateral and other cooperation mechanisms. They can be by agreement with foundations and governments, by open demand in agreement with universities, or in programs without subsidy. Fellowship amounts and conditions depend on the benefits that third governments, foundations, or other institutions may choose to grant. For example, for the year 1999, the number of loans offered in open demand without subsidy is 583 (this figure includes the offer of universities that have agreements with third-country institutions).

Among the fellowships that are made available by these cooperation mechanisms, the following may be mentioned in connection with CONACYT: with the United States, there is the Fulbright-García Robles program for master's and doctorate degrees, consisting of 80 fellowships for engineering and natural and exact sciences, and 40 fellowships for social sciences, including the following disciplines: economics, education, sociology, philosophy, political science, anthropology, linguistics, and psychology. With Great Britain, within the framework of the Anglo-Mexican Exchange Program (British Council), a total of 10 master's and doctoral fellowships are offered in 1999 for studies in environment, agricultural sciences and fisheries, aquaculture, biotechnology, food science, and electrical and mechanical engineering. The same exchange program (British Embassy) offers five fellowships in economics, international relations, public administration and planning, business administration, and political science and law. France offers a total of 40 doctoral fellowships in civil engineering, chemical engineering, chemistry, biotechnology, biochemistry, microbiology and food science, geological engineering and mining, water resources, electrical and electronic engineering, automation, informatics, agronomy, and ecology and environment (CONACYT 1998a). CONACYT also has exchange and collaboration programs with most Latin American science and technology councils. Among the 50 foreign universities in greatest demand by CONACYT's fellowship-holders, 19 are in the United States, 13 are in Great Britain, 7 each are in France and Spain, and 4 are in Canada (see appendix table 9).

In 1991, the Presidential Fund for Retention in Mexico and Repatriation of Mexican Researchers was established, resulting in 1,149 repatriations through 1996, with the aim of reinforcing the academic staff of higher education institutions (Bonilla-Marín and Martuscelli 1997). CONACYT provides the necessary funds for 1 year to cover salaries and other monetary incentives, depending on the decision of the collective institutional organs and the evaluation committee of the repatriation program. It also covers the travel expenses of the researcher and his or her family to settle in the selected location. The funds are granted to the recipient institution and aim to facilitate the swift hiring of the researcher, thus giving time to the institution to plan the creation of the new position required within the scope of 1 year.

The program has attracted mostly young researchers willing to start their professional lives after obtaining their doctorates or carrying out postdoctoral stays (the average age is 35), while only a few Mexican senior researchers established abroad have applied. The field of biological sciences registers the highest proportion of beneficiaries, followed by those in applied sciences (biological and engineering) and basic sciences. There are few applications from the human and behavioral sciences. The D.F. has a concentration of 42 percent of all repatriated researchers. The percentage of repatriated researchers absorbed by private institutions is low (6 percent); one institution (Instituto Tecnológico de Estudios Superiores de Monterrey) has hired 4.87 percent of these. UNAM (which has absorbed 24 percent), UAM (4 percent), IPN (2.5 percent), and the technological institutes (3 percent) together comprise 58 percent of all the beneficiaries. The majority of researchers—86 percent—come from six countries: Germany, Canada, Spain, France, the United

Kingdom, and the United States. From this latter country come 38 percent of the total. It may be noticed that 2.5 percent corresponds to retention within Mexico.

Of all repatriated researchers, 62 percent have joined the National System of Researchers. Of all those repatriated in the 1991-96 period, 0.9 percent of have gone abroad again. The number of doctors added to the national scientific community through the repatriation program, although lower than that resulting from graduates from Mexican doctoral programs, is comparable to the latter number. Adding up the two contributions affords a very close approximation to the total number of doctors who each year join the Mexican scientific and technological system.

Discussion

Some of the problems detected in the domestic graduate programs in Mexico (Bazúa y Meza 1996, pp.18-19) are:

- lack of definition and little clarity in the aims and objectives of the graduate program and its options;
- weak links between graduate education and the public and private productive sectors;
- the fact that research does not constitute a training line in some master's and doctoral programs;
- few inter-institutional programs;
- insufficient multidisciplinary or interdisciplinary graduate programs;
- absence of an effective tutorial system;
- imbalance in enrollment distribution among different fields of knowledge;
- high student attrition rate;
- low graduation rates and excessive time to degree with regard to institutional expectations;
- low research productivity of teaching staff in some of the graduate programs;
- imbalances in the offer of graduate programs;
- serious educational handicaps among candidates to the graduate programs; and
- absence of links between the graduate level and the *licenciatura* and other educational levels.

In a recent report, OECD (1997) examiners concluded that it is necessary to develop the graduate level, not in an anarchic manner wherein each institution decides for itself, but through the establishment of networks, in order to try to respond effectively to the new needs of research and higher education and to avoid an onerous prolongation of already lengthy studies.

Colombia

Recent Reforms

In the last 30 years, a scientific community in Colombia has begun to take shape, characterized by faculties that concentrate considerable numbers of full-time teachers; foreigners or Colombians trained abroad in new scientific subjects; laboratory equipment quite adequate for its time, provided by international cooperation—the Inter-American Development Bank, Rockefeller and Ford Foundations, UNESCO, etc.; incipient graduate programs; and a public institution that began to fund research. By 1996, the Colombian R&D community was said to number 7,700 persons (RICYT). At the beginning of the 1990s, science and technology were assumed to be the pillars of the current development strategy of Colombia's government, reflected in the National System of Science and Technology that was established by Law 29 of 1990 and implemented in 1991 through its organization into 11 National Programs of Science and Technology: basic sciences; social and human sciences; environmental and habitat sciences; education; health sciences and technologies; agricultural sciences and technologies; industrial technology development and quality; electronics, telecommunications, and informatics; energy and mining; biotechnology; and sea sciences and technologies. The Colombian Institute for the Development of Science and Technology "Francisco José de Caldas" (COLCIENCIAS) was transferred from the Ministry of Education and assigned to the National Department of Planning, in order to increase its capacity of strengthening research and technological development and to make it serve as the technical secretariat of the National Council of Science and Technology.

Within this institutional framework, emphasis is placed on the following aspects:

- integrating the private sector through its participation in the national councils;
- creating new forms of association between the public and private sectors, based on the Law of Science and Technology, through the establishment of mixed corporations of private law;
- decentralizing research through the creation of seven regional commissions of science and technology;
- developing human resources; and
- fostering the integration of Colombian scientists and engineers into international networks of science and technology.

Graduate Enrollment and Degrees

Among the limiting factors of science and technology development, the insufficient number of researchers and qualified human resources was recognized as possibly being the main bottleneck (Departmento Nacional de Planeamiento 1994, p. 5). At the beginning of the 1990s, graduate education in Colombia was considered to be far from fulfilling its mission as a tool for the training of researchers (COLCIENCIAS 1991). In the report of the Misión Ciencia, Educación y Desarrollo produced in 1995 for the Presidency of the Republic, the following goals for capacity building in the domain of human resources in the natural and social sciences and in engineering were set for the forthcoming 10 years:

- training 8,000 scientists with doctorate degrees;
- training 10,000 specialized professionals: individuals holding professional degrees and master's or specialist graduate diplomas; and
- training 18,000 nonspecialized professionals: technologists and technicians devoted to R&D.

These figures derived from population estimates that, according to the Colombian Institute for the Development of Higher Education (ICFES), had graduated from the university in 1990—41,000 from undergraduate education and 2,500 at the graduate level. A survey on the research potential of university students showed that 6 percent of students enrolled in the experimental sciences (medicine, physics, chemistry, and biology) had the requisite conditions to become good researchers. On this basis, assuming that 3 percent of all undergraduates had such a profile and that among graduate students the percentage is closer to 10 percent, it was considered reasonable to foresee at least 1,500 professionals per year with a tendency toward research—a figure close to the 1,800 envisaged in order to reach the proposed goals. The remainder could eventually be provided with the contribution of people from previous generations that in the past could not continue their careers for various reasons but who could be absorbed by the program through the new mechanisms and incentives set in place (Misión Ciencia, Educación y Desarrollo 1995, pp. 231-35).

Table 6. Recipients of university degrees, Colombia, 1990-95

Field	1990	1991	1992	1993	1994	1995
Total	41,431	48,897	46,103	47,016	57,114	54,188
Exact and natural sciences	802	773	528	589	859	685
Engineering and technology	8,105	9,369	8,521	9,493	11,275	11,036
Medical sciences	5,208	5,874	5,758	5,307	7,071	6,968
Agricultural sciences	1,030	1,329	806	972	761	957
Social sciences	25,812	30,817	29,653	29,627	36,136	33,636
Humanities	474	735	837	1,028	1,012	906

SOURCE: Colombian Institute for the Development of Higher Education (ICFES), *Estadísticas de la Educación Superior.*

Table 7. Recipients of masters degrees or equivalent, Colombia, 1990-95

Field	1990	1991	1992	1993	1994	1995
Total	1,226	1,716	1,703	2,359	2,444	2,396
Exact and natural sciences	68	76	78	158	124	87
Engineering and technology	161	143	86	137	168	104
Medical sciences	475	625	649	849	879	920
Agricultural sciences	7	15	0	66	31	25
Social sciences	468	816	826	1,067	1,144	1,127
Humanities	47	41	64	82	98	133

SOURCE: Colombian Institute for the Development of Higher Education (ICFES), *Estadísticas de la Educación Superior.*

The aims of Colombia's current science and technology policy in this regard are to increase the quality and size of the domestic scientific community through training—especially at the doctoral level in the various fields of the natural and social sciences, and in engineering—to

stimulate research and give strong incentives to researchers, while helping solve the deficit of this level of qualification in Colombian universities and enabling the generational renewal of researchers. COLCIENCIAS's policy addresses six main lines of action: training toward a degree (doctorate or master's), training in nondegree or continuing education, strengthening of domestic doctoral programs, promotion of young researchers, incentives to researchers, and support of exchange programs and visiting researchers. The government goal in 1994 was to train 2,000 new researchers in the 1994-98 period. Of these, 550 were expected to be trained at the doctoral or master's level, through COLCIENCIAS's programs, granting fellowships in the country and abroad.

Table 8. COLCIENCIAS Human resource program, Colombia, 1995-98

Program	Number of beneficiaries	
	1995-96	1998[b]
Doctorate and master's scholarships	297	463
Courses and *pasantías*[a]	1,233	2,329
Young researchers	237	435
Support to doctoral infrastructure	24	24
Researcher mobility	32	35
Incentives for researchers	283	283

[a] pasantías = visit to a foreign university.

[b] Preliminary figures.

SOURCE: The Colombian Institute for the Development of Science and Technology (COLCIENCIAS).

FELLOWSHIPS

Support for developing a fellowship program was provided by COLCIENCIAS, the Colombian Institute for Educational Loans and Technical Studies Abroad (ICETEX), and the Foundation for the Future of Colombia, as well as new programs of professional training advanced by the various ministries and international cooperation resources. To ensure adequate availability of students, it was considered necessary to support undergraduate programs as well, offering loans or donations geared to the improvement of the educational infrastructure. ICETEX and COLCIENCIAS fellowship mechanisms were reinforced, and both institutions—in a combined effort—signed a series of agreements with international organizations having wide experience in the management of fellowships in several countries. By 1997, they had signed agreements with LASPAU, the British Council, and the Ibero-American States Organization. Talks were also under way with Germany's DAAD and similar agencies in France, Switzerland, Canada, Israel, and Japan (COLCIENCIAS 1997a, p. 7). The basic sciences received 30 percent of the fellowships in the 1995-97 period, followed by the social and human sciences (16 percent) and health science and technology (14 percent).

Taking into account that each fellowship has a 4-year maintenance and fees component, in addition to travel and installation costs, thesis expenses, the acquisition of a

Table 9. Number of fellowship holders by COLCIENCIAS S&T program, Colombia, 1995-97

Program	1995		1996		1997		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	139	100.0	141	100.0	183	100.0	463	100.0
Biotechnology	6	4.3	6	4.3	2	1.1	14	3.0
Agricultural S&T	5	3.6	9	6.4	14	7.7	28	6.0
Health S&T	28	20.1	21	14.9	16	8.7	65	14.0
Sea S&T	3	2.2	8	5.7	6	3.3	17	3.7
Basic sciences	43	30.9	37	26.2	60	32.8	140	30.2[a]
Environment and habitat	19	13.7	13	9.2	5	2.7	37	8.0
Social and human science	11	7.9	27	19.1	38	20.8	76	16.4
Industrial technology development and quality	6	4.3	10	7.1	25	13.7	41	8.9
Electronics, information, and telecommunications	6	4.3	7	5.0	11	6.0	24	5.2
Education	1	0.7	2	1.4	4	2.2	7	1.5
Energy and mining	11	7.9	1	0.7	2	1.1	14	3.0

[a] Many are doing molecular biology.

KEY: S&T = Science and technology

SOURCE: The Colombian Institute for the Development of Science and Technology (COLCIENCIAS).

computer, and books, a quick estimate indicates that domestic doctoral fellowships cost considerably less than those granted to study in foreign universities—a little more than half the cost abroad (see appendix table 10).

The nondegree training programs are oriented to the development of postdoctoral and research visits to centers of excellence in the country and abroad, with a duration of between 3 and 24 months. The purpose is to encourage an active exchange between Colombian researchers and their colleagues in other countries through participation in research projects and specialized courses aimed at updating researchers about new techniques. Between 1996 and 1998, eight postdoctoral fellowships were granted. It is expected that this number will grow in the future, since they are perceived as a useful mechanism for making the Colombian research community more dynamic and fostering its international mobility and visibility.

Actions directly related to scientific capacity building through training are complemented with other actions aimed at consolidating and improving the local environment for research. Thus the Program of Young Researchers aims at linking young researchers to high-quality research centers or groups, fostering in them a feeling of belonging to specific scientific communities and encouraging their participation in institutional environments conducive to their growth in science. About 30 percent of the beneficiaries are in the agricultural sciences and technologies (133 individuals), 20.7 percent in the social sciences and humanities (90), 16.1 percent in the health sciences and technologies (70), and 14.7 percent in the basic sciences (64).

Table 10. COLCIENCIAS number of "young researchers" by S&T program, Colombia, 1995-98

Program	1995		1996		1997		1998[a]		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	112	100	125	100	157	100	41	100	435	100
Biotechnology	0	0	11	8.8	4	2.5	7	17.1	22	5.1
Agricultural S&T	14	12.5	39	31.2	56	35.7	24	58.5	133	30.6
Health S&T	32	28.6	18	14.4	20	12.7	0	0	70	16.1
Sea S&T	0	0	0	0	1	0.6	0	0	1	0.2
Basic sciences	31	27.7	19	15.2	12	7.6	2	4.9	64	14.7
Environment and habitat	3	2.7	3	2.4	16	10.2	0	0	22	5.1
Social and human science	32	28.6	18	14.4	40	25.5	0	0	90	20.7
Industrial technology development and quality	0	0	13	10.4	2	1.3	6	14.6	21	4.8
Electronics, information, and telecommunications	0	0	0	0	6	3.8	0	0	6	1.4
Education	0	0	0	0	0	0	0	0	0	0
Energy and mining	0	0	4	3.2	0	0	2	4.9	6	1.4

[a] Data are through May 31, 1998.

SOURCE: The Colombian Institute for the Development of Science and Technology (COLCIENCIAS).

Another pillar of the COLCIENCIAS program toward the consolidation of the national scientific community is support of the infrastructure and development of National Doctoral Programs in those fields where it is possible to develop good-quality centers in the country. These programs are supported through the funding of research programs and the consolidation of their infrastructure. In 1998, there were 31 doctoral programs in Colombia, 17 in the exact and natural sciences and health (5 in physics, 4 in chemistry, 1 in mathematics, 7 in biology and biomedical sciences); 3 in engineering and technology; 2 in agricultural sciences and technologies; and 8 in the social sciences and humanities (1 in law, 2 in education, 2 in philosophy, 1 in theology, 1 in history, 1 in economics). ICFES is in charge of the accreditation of all graduate programs.

Currently, there are 103 groups and centers recognized by COLCIENCIAS to which financial aid has been given to help in their maintenance. It is estimated that COLCIENCIAS ought to support an increasing number of units, assuming a reasonable increment of 10 centers and groups per year until 2003.

Through its various mechanisms, COLCIENCIAS is having an impact on the institutional culture with regard to the processes of preselection of candidates who apply to the national fellowship program. Institutions are increasingly giving guaranteed acceptance to young persons with deserving scientific and academic qualifications. It also

helps formulate and implement institutional plans for human resource training on the part of universities and other institutions in less developed regions of the country.

International Mobility

The Researchers' Mobility Program has supported a modest number of people in the 1995-98 period, 35 in all. Nonetheless, through requirements of study-loans (return to the country, high domestic and international scientific productivity, establishment of links between Colombian institutions and their research groups with counterparts abroad where the graduate student is receiving his or her training), effective international linkages have been made on behalf of domestic institutions and research groups.

The Colombian government pays great attention to its science and technology community abroad: "diaspora" is the term chosen by the official program about the Colombian Network of Scientists and Engineers Abroad—CALDAS Network. This program was established at the end of 1991 by COLCIENCIAS as intrinsically tied to the international dynamics of the national community. The program's underlying philosophy has been that a network of skilled expatriates is an extension of, and not a substitute for, the national community. Colombian intellectuals linked by this program were in the recent past spread in up to 43 countries, with the largest contingent in the United States. It is a highly qualified community: 71 percent of its members have obtained or are pursuing doctoral studies, and 80 percent have a master's degree or equivalent. A recent analysis of the program suggests that there is a bottleneck in higher education at the level of doctoral studies in the country; this would help explain why three-fourths of those who left did so to pursue graduate studies abroad. Emigration, however, does not seem permanent but rather of the delayed return kind. Although the program does not have the necessary depth of time to allow us to assess this aspect, the final outcome will most likely depend on country conditions. Half the population surveyed had student status, of which 74 percent had enrolled in a Ph.D. program, 18 percent in a master's program, and 8 percent in undergraduate studies. Two-thirds were under professional contract, one-fourth were both studying and working, and 83 percent declared that they were involved in research activities either as advanced students or professionals (Meyer et al. 1997).

Of course, not all expatriates belong to the CALDAS Network, and a population of expatriate individuals does not automatically constitute a diaspora. According to the definition given to this notion by COLCIENCIAS, "an expatriate population becomes a diaspora when it is a community whose members are in communication, have built and institutionalized a collective autonomy, and share some goals and activities. This the CALDAS Network provides through its electronic list, local nodes, and joint projects." According to governmental sources, the Colombian science and technology diaspora comprises around 2,000 people. This represents a little less than half of the people officially involved in R&D activities in Colombia.

Venezuela

Recent Reforms and Trends

The Venezuelan higher education system has experienced an enormous expansion in the last 30 years. Many initiatives for change from different segments linked to higher education popped up in recent years, spurred by internal factors like the aging of the community of researchers, the retirement of an important fraction of university academic staff, the move of many others abroad or to industry and services without their posts being replenished at the same rate, a deterioration of academic staff salaries, and reduction in the number of university students in the basic sciences. Nonetheless, the profound transformations visible in other Latin American countries in response to changed world conditions have been slower to come by in this country. The main external factors of higher education change observed in Venezuela are evaluation, funding, the research issue, and the development of a coordination model. All of these are deeply affected by the crisis of the state.

The funding of higher education has been incremental on the basis of previous budget assignments, although in the last decade criticisms became more intense in view of the system's inability to incorporate incentives for the improvement of the system's internal efficiency and quality, as well as criticisms of the excessive weight of corporate and political parties' pressures, which have undermined public higher education. Institutions have strongly resisted evaluation and accreditation of graduate educa-

tion. There has been limited financial support for self-evaluation processes, which—along with a centralized system of quota distribution which has introduced rigidities—has promoted conflicts with the student body and become difficult to change.

The evaluation process in Venezuela has been based on a corrective notion; that is, it has been restricted to certain problems, and careful not to change funding structures. Evaluation has been accepted as long as it does not affect existing budget and financial structures. The creation of the Consultative Council of Graduate Studies in 1983 as an advisory organ of the National Universities Council (CNU) enabled the creation of a National System of Graduate Accreditation in 1986. Although the impact and effectiveness of this council have been very modest (up to now, only 20 percent of all graduate programs have submitted to the evaluation procedure of accreditation), nonetheless it deserves to be mentioned as a policy initiative that has to some extent institutionalized a form of specialized evaluation. Also in 1983, CNU established a Universities Institutional Evaluation Commission; in the ensuing decade, some evaluation took place with the participation of the Nucleus of Universities' Planning Directors. Given CNU's past difficulties in articulating the interests of government and universities, it is currently moving toward a new evaluation policy that is more responsive to contextual features. The Presidential Commission for the Development of Higher Education is in charge of designing the Inter-American Development Bank's Venezuelan Program for the Improvement of Higher Education, envisaging two components: a fund for the reform of higher education, and a fund for the institutional support of the reforms.

In 1990, after a decade of efforts by members of the scientific community to get it established, the Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT) created the System for the Researcher's Promotion (PPI). PPI emerged as a national structure of accreditation for researchers through the usual evaluation mechanisms of the scientific community, with the aims of giving them visibility in the domestic context and providing a monetary incentive which, by comparison with the equivalent Mexican SNI, never became really significant in relation to the beneficiaries' salaries. PPI was created as a mechanism that tried first to compensate for a deficit in the collective recognition of the researcher's status and role—which in the past had resulted in a very fragile relationship of research and its fruits with Venezuelan society—and second, to foster the participation of Venezuelan science in the international scientific system (Vessuri and González 1992, and Vessuri 1996). The limitations of this program have been said to lie in its fostering a relative isolation of the individual scientist from other social priorities, as well as the promotion of certain patterns of work organization, particularly solo rather than group research, which is more easily found in basic academic science and which in the long run might be counterproductive for science for development. Meanwhile, other evaluation tools have began to emerge in many universities—though still precariously. These include the Academic Benefit, an incentive created by CNU; and incentive programs implemented by several public universities, such as the Program of Incentives to Research for university academic staff.

It will be necessary to specify what the future role and position of PPI will be, and how the various incentives can be made complementary rather than contradictory. Because the roles of the researcher and research are not yet sufficiently consolidated in Venezuelan society, PPI, although it cannot be permanent, may continue to be necessary for some time. The researcher population of approximately 1,500 may be considered the core of the domestic scientific community, suggesting that a small but very qualified stratum of researchers has become consolidated. Depending on whether strict or broad criteria are used, it may be estimated that the number of people in R&D includes between two and five times that number. The consolidated information about PPI members in 1998 is included in tables 11 and 12.

Table 11. Number of researchers in Venezuela's PPI program, Venezuela, 1998

Institution	Physical, chemical, & mathematical science	Medical, biological & agricultural science	Social science	Engineering, technology & Earth science	Total
Total.....	360	640	310	240	1,550
UCV.....	65	188	103	49	406
ULA.....	88	93	62	37	281
LUZ.....	34	90	57	36	217
USB.....	83	31	43	70	207
Others...	90	238	45	48	439

KEY: PPI= Program for the Promotion of Researchers
ULA= Universidad de Los Andes
USB= Universidad Simón Bolívar
UCV= Universidad Central de Venezuela
LUZ= Universidad del Zulia

SOURCE: National Council of Science and Technology Studies, (CONICIT), *Sistema de Promoción del Investigador,* Caracas,1998.

Table 12. Number of researchers, according to promotion research program (PPI) level, 1990-97

Level	1990	1991	1992	1993	1994	1995	1996	1997
General total.....	760	922	941	929	1,056	1,213	1,302	1,435
Candidate.....	111	171	220	167	197	241	310	322
I.....	390	482	407	472	519	614	632	755
II.....	150	173	213	180	243	262	251	246
III.....	89	96	101	110	82	81	94	97
Emeritus.....	0	0	0	0	15	15	15	15

SOURCE: National Council of Science and Technology Studies, (CONICIT), Indicadores de la capacidad de investigción y desarrollo de Venezuela. Periodo 1990-98. Sistema de Promoción del Investigador, Caracas,1998.

Some fields show a greater weight, as in catalysis, where there are at least 152 active Ph.D. level researchers in 11 institutions (Vessuri 1996). But it is increasingly evident that the traditional way of understanding and doing research in the country—structurally weak, isolated from economic and social processes, and individualized to a large extent—must be drastically changed to make it more effective. Thus, it may be said that Venezuela is in a transitional stage.

CONICIT has undergone internal transformation to ease the modernization of the science and technology system. Since 1994, it has established four main fields of programmatic action for the support of research, innovation processes, policies for the strengthening and coordination of the national effort in science and technology, and internal management and institutional modernization. With regard to the first aim, with which we are more directly concerned here, among the strategic lines of action are training, incorporation, and permanence of more and better researchers; and, linked to these, the strengthening of research in domestic graduate programs. Several actions were started or redefined in the last 3 years:

- Funding was provided for the training of researchers, with some 300 new graduate fellowships envisaged for the 1996-98 period.

- New researchers were incorporated, facilitating the hiring of young researchers in research and teaching activities in higher education institutions, and aiming at 375 graduates.

- Researcher mobility was encouraged. The target was to fund 1,333 new applications, facilitating the participation of active researchers in international events, as well as linking Venezuelan researchers settled abroad with the domestic community and starting a networking program for Venezuelan scientists and engineers resident abroad (the Perez Bonalde Program).

- Research technicians are being trained, with a target of 58 technicians (CONICIT 1996).

- Within the Special New Technologies Program, 20 fellowships in Venezuela and 129 fellowships abroad are being provided; also envisaged are 15 updating courses and the participation of scientists in 10 national events.

- As in Colombia, special lines of action include the support of research groups and the strengthening of domestic graduate programs.

The main emphasis is ensuring that the nation's R&D capacities become a substantial part of its economic and social processes, bringing solutions and opportunities to the productive sector and society in general.

Enrollment and Degrees

Higher education enrollment in Venezuela increased 30 times over the last 30 years. In 1994, higher education accounted for 43.6 percent of the national educational budget, which in turn was 15.36 percent of the national budget. The schooling ratio of higher education went from 6 percent in 1965 to 24 percent in 1990. In 1995, there were 603,217 students enrolled in higher education, 76.2 percent of them in universities. The number of graduates that year was 50,160, 65.6 percent from universities. The total ratio of graduates from higher education in 1995 was generally low—37 percent (50,160 graduates, 136,092 newly enrolled in 1990). Contrary to common expectations, public universities have a higher terminal efficiency

than private universities—49 percent: 28,402 graduates in 1995, 57,989 newly enrolled in 1990; versus 26 percent: 4,489 graduates in 1995, 16,955 newly enrolled in 1990—and continue to receive a much larger student enrollment. The situation differs in nonuniversity institutions. In this grouping, the graduate ratio is 20 percent in the public sector (4,269 graduates in 1995, 21,528 newly enrolled in 1990) and 33 percent in the private sector (12,973 graduates in 1995, 39,620 newly enrolled in 1990) (Parra 1998, based on OPSU 1997).

Historically, higher education in Venezuela has been devoted mostly to undergraduate education, although in the last 10 years it has expanded its number of academic graduate programs. In 1972, there were only 89 graduate programs; by 1994, there were 1,047, comprising 7 percent doctoral programs, 46 percent master's, and 47 percent specialization programs. Public universities account for more than half of the graduate programs; of these, the Central University of Venezuela (UCV) has 32 percent of all graduate programs.

FELLOWSHIPS

Although official initiatives to support domestic graduate education go back to at least the mid-1970s, emphasis was placed on graduate fellowship programs to study abroad. However, results were not as effective as expected in terms of a multiplying effect of returning graduates on growth of the local research community; also, it was estimated that a considerable number of students abroad were lost to "brain drain." Therefore, more recent initiatives—developed by CONICIT, FUNDAYACUCHO (Gran Mariscal de Ayacucho Foundation), and several university councils for the development of science, technology, and the humanities—have focused on renewed support of domestic graduate education in fields of domestic strength, combined with a policy for graduate training abroad in strategic fields and in those that are weak at the local level.

The main fellowship programs are those of FUNDAYACUCHO and CONICIT. Between 1984 and 1997, the two combined made available an average of 688 fellowships per year to Venezuelan graduates. Until the current decade, FUNDAYACUCHO's fellowship program was numerically much larger than CONICIT's, having granted a total of 55,484 fellowships from 1975 to 1996 at both the undergraduate and graduate levels. Since 1984, it granted 8,202 graduate fellowships, compared to 1,439 fellowships from CONICIT. The latter specialized in research fellowships on a much smaller scale. Since 1991, however, CONICIT has increased its efforts, and, in 1995-97, its fellowships represented about a third of FUNDAYACUCHO's loans. Throughout the period, the average number of fellowships abroad from the two agencies combined was 47 percent, with a high of 77.74 percent in 1993 and a low of 10.52 percent in 1987. (See appendix table 11.)

Table 13. Number of fellowships and educational loans granted by CONICIT and FUNDAYACUCHO in Venezuela and abroad, 1984-97

Year	General total	Total Venezuela	Total abroad	(%)	CONICIT			FUNDAYACUCHO		
					Total	Venezuela	Abroad	Total	Venezuela	Abroad
1984	667	348	319	(47.8)	30	21	9	637	327	310
1985	813	664	149	(18.3)	1	1	0	812	663	149
1986	282	215	67	(23.8)	54	37	17	228	178	50
1987	1,178	1,054	124	(10.5)	35	22	13	1,143	1,032	111
1988	213	174	39	(18.3)	37	20	17	176	154	22
1989	127	60	67	(52.8)	3	3	0	124	57	67
1990	657	454	203	(30.9)	80	56	24	577	398	179
1991	987	427	560	(56.7)	124	60	64	863	367	496
1992	554	199	355	(64.1)	154	42	112	400	157	243
1993	921	205	716	(77.7)	209	59	150	712	146	566
1994	565	157	408	(72.2)	24	0	24	541	157	384
1995	473	214	259	(54.8)	152	92	60	321	122	199
1996	865	338	527	(60.9)	251	144	107	614	194	420
1997	1,339	600	739	(45.8)	285	159	126	1,054	441	613

SOURCE: National Council of Science and Technology Studies, (CONICIT), Indicadores de la capacidad de investigción y desarrollo de Venezuela. Periodo 1990-98 Sistema de Promoción del Investigador, Caracas,1998.

The public universities also have fellowship programs to qualify their own academic staff, administered through their science, technology, and humanities development councils. There are no global figures about this universe of fellowships. However, their significance in the overall effort can be grasped from the evolution of the UCV fellowship program. On the whole, from the creation of the mechanism in 1958 through 1996, UCV granted 603 graduate fellowships, of which 21.9 percent were distributed among the social sciences and the humanities. The largest concentration of graduate fellowships was awarded to science faculty staff (25 percent), followed by the agronomy faculty (15.6 percent) and medicine (13.2 percent). The largest concentration of fellowships (47.42 percent) occurred in the 1977-86 period; significantly, the number of doctoral fellowships represented 54.57 percent of the total. This trend continued in the 1987-96 period, with 51.46 percent of all fellowships awarded for doctoral studies.

Note that most doctoral and master's fellowships from FUNDAYACUCHO are for studies abroad, with the largest contingents of students in economics and the social sciences, followed by engineering and technology. The basic sciences, with 22.2 percent in the domestic doctoral programs and 14 percent in foreign ones, have a better representation at this level than at lower levels. At the master's level, 71.1 percent of domestic fellowships go to students in economics and the social sciences; and, although the proportion is lower among master's level fellowships abroad in these disciplines, the proportion continues to be considerable (59.1 percent).

A larger proportion of FUNDAYACUCHO doctorate fellowships are destined for Spain than for any other country (38.2 percent), followed by the United States and the United Kingdom. The remaining destinations show a great dispersion. At the master's level, 68 percent of all fellowships abroad are for the United States; Spain and the United Kingdom trail far behind, with 10.3 percent and 9.6 percent, respectively.

CONICIT has granted a comparable number of fellowship in the 1994-97 period (712). This agency emphasizes the doctorate degree level, which every year has accounted for more than 40 percent of all fellowships granted. A new modality that is growing slowly is that of the postdoctorate. Table 16 provides some indication of destination trends based on the history of CONICIT fellowships. The United States was the destination of 42.9 percent of all fellowships, followed by the United Kingdom with 21.6 percent and France with 14.8 percent.

International Mobility

In recent years, Venezuela has been developing several programs to identify Venezuelan expatriates. CONICIT has initiated a modest scheme, the Perez Bonalde Program, which brings Venezuelan scientists settled abroad in country for short visits to local research institutions and groups in order to fulfill a work agenda geared to increase contacts and international mobility of local scientists; it also aims to incorporate those expatriate researchers in the domestic dynamics of science and technology. Fundación Polar is collecting information about

Table 14. FUNDAYACUCHO educational loans granted at the graduate level, Venezuela and abroad by field of study, 1994-98 (PRCE budget)

Field	Venezuela					Abroad				
		Master's		Doctorate			Master's		Doctorate	
	Total	Number	Percent	Number	Percent	Total	Number	Percent	Number	Percent
Total	393	384	100.0	9	99.9	1,252	1,074	99.4	178	100.1
Basic sciences	5	3	0.8	2	22.2	43	18	1.7	25	14.0
Engineering	61	61	15.9	0	0.0	318	276	25.7	42	23.6
Agricultural and sea science	8	8	2.1	0	0.0	22	13	1.2	9	5.1
Health	10	9	2.3	1	11.1	65	49	4.6	16	9.0
Education	29	26	6.8	3	33.3	60	46	4.3	14	7.9
Economic and social sciences	275	273	71.1	2	22.2	694	635	59.1	59	33.2
Humanities, literature and fine arts	5	4	1.0	1	11.1	50	37	3.5	13	7.3

KEY: PRCE = Educational Credit Reform Budget, Venezuela, World Bank.

NOTE: For the vear 1998. the first semester onlv was considered.

SOURCE: Gran Mariscal de Ayacucho Foundation (FUNDAYACUCHO).

Table 15. FUNDAYACUCHO educational loans granted at the graduate level according to geographical destination, Venezuela, 1994-98 (PRCE budget)

Level/Country	Total	Master's Number	Doctorate Number
Total	1,645	1,458	187
Total abroad	1,252	1,074	178
Total Venezuela	393	384	9
Argentina	2	1	1
Australia	11	5	6
Belgium	3	1	2
Brazil	6	6	0
Canada	20	19	1
Chile	4	4	0
China	1	1	0
Colombia	2	1	1
Costa Rica	29	23	6
France	43	25	18
Germany	4	2	2
Holland	6	6	0
Israel	0	0	0
Italy	7	7	0
Mexico	16	16	0
Nicaragua	9	9	0
Peru	0	0	0
Puerto Rico	3	3	0
Russia	1	0	1
Spain	179	111	68
Sweden	1	1	0
Switzerland	3	1	2
United Kingdom	138	103	35
United States	763	728	35
Uruguay	1	1	0

KEY: PRCE = Educational Credit Reform Budget, Venezuela, World Bank.

NOTE: For the year 1998, the first semester only was considered.

SOURCE: Gran Mariscal de Ayacucho Foundation (FUNDAYACUCHO).

Venezuelan scientists abroad, trying to distinguish those who are pursuing studies from those who are working on a more permanent basis. So far, it has identified some 300 Venezuelan scientists and engineers settled abroad on a more permanent basis. The Venezuelan Embassy at UNESCO headquarters in Paris has started an initiative called TALVEN with a similar purpose. In the near future, these programs should coordinate with each other to produce unified information.

Streamlining Academic R&D in Mexico, Colombia, and Venezuela

The recent reforms introduced in the academic world of the three countries considered here, like those in other Latin American countries, seem to point to the rationalization, disciplining, and greater efficiency of higher education. Since the tools of reform have been basically financial and administrative and not often supplemented with more integral changes, the results remain pending. There is no doubt that groups of researchers have been mobilized around new funding modalities and opportunities. But the bulk of university staff (teachers and research assistants) seem to have received the impact of the reforms in different manners. Some groups feel they have been ill-treated by the imposition of quantitative research evaluation criteria that apply to the tradition of the physical sciences but are not pertinent to the agricultural sciences, technologies, social sciences, and humanities; they feel these are even less able to measure yields in teaching, the effectiveness of adjustment to market demands, etc. Operational measures assumed to make research more efficient, such as supporting large research groups for more or less extended periods (3 to 4 years), may reflect optimal research conditions for some disciplines, but not necessarily for others.

Table 16. Number of fellowships by academic level CONICIT, Venezuela, 1994-97

Year	Fellowships		Master		Doctorate		Postdoctorate		Does not indicate	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	712	100.0	342		332		32		6	
1994	24	3.4	4	16.7	15	62.5	4	16.7	1	4.2
1995	152	21.4	75	49.3	69	45.4	5	3.3	3	2.0
1996	251	35.3	127	50.6	111	44.2	11	4.4	2	0.8
1997	285	40.0	136	47.7	137	48.1	12	4.2	-	0

KEY: (-) = not applicable

SOURCE: National Council of Science and Technology Studies, (CONICIT) n.d. <<http://www.conicit.gov.ve>>.

Table 17. Number and percentages of fellowships granted by CONICIT, Venezuela, by country of destination, not including domestic fellowships, 1970-97

Country	Number	Percent
Total	898	100
Australia	3	0.3
Belgium	7	0.8
Brazil	25	2.8
Canada	23	2.6
Cuba	1	0.1
Czechoslovakia	2	0.2
France	133	14.8
Germany	14	1.6
Holland	3	0.3
Israel	1	0.1
Italy	5	0.6
Japan	3	0.3
Mexico	4	0.4
New Zealand	1	0.1
Poland	1	0.1
Puerto Rico	3	0.3
Russia	3	0.3
Spain	80	8.9
Sweden	4	0.4
United Kingdom	194	21.6
United States	385	42.9

SOURCE: National Council of Science and Technology Studies, (CONICIT) n.d. <<http://www.conicit.gov.ve>>.

The industrial sector emerges as a strategic partner to facilitate change; its difficulties in the current process of economic aperture and the vulnerability of domestic financial markets affect R&D stability and potential for expansion. The three countries have learned that expansion of high-quality academic research does not necessarily create conditions for high-quality industrial R&D. Academic research policy, therefore, should not be dissociated from industrial firms' applied R&D policy and practice, where the means of government influence are much more indirect, complex, and controversial.

Although in the last decades the range of organizations and institutions has been growing and diversifying in the three countries, the institutional fabric still presents thinly covered holes and empty spaces. In addition to the institutional and organizational insufficiency and marginality of science and technology research with regard to the main route of knowledge production and distribution, confidence in government management—considered in the past to be the natural agency in charge of responding to problems of collective development—has declined. The preexisting export industrial base fed on governments that supported—at least in the early stages—the industrialization process, with policies of exchange rates, restriction of domestic demand, real salary restrictions, export subsidies, export processing zones, and performance requirements for exports, as well as investments in research, training and support infrastructure. Maintenance of industrial growth requires fresh, sustained investments for capacity development.

In countries like these, distant from the technological edge, the returns associated with facilitating technology transfer are much higher than those linked to engaging in original R&D. An important policy to facilitate such transfer is to invest in human resources, especially in higher education. As far as graduate education is concerned, we have seen that total enrollment is very low relative to the numbers graduating from undergraduate programs; the graduate-undergraduate ratio shows the need to prioritize growth of graduate education. There is a definite insufficiency in the level, quality, and variety of human resources required for technological upgrading. The knowledge gap grows dramatically, especially in aspects related to the integration of human resources in innovation systems.

The fact that the majority of teaching/research posts in the public sector corresponds to the status of *funcionario público* (public official) induces too much stability of employment for those who are in the system and an exceedingly high turnover of "marginal" professionals who remain outside the system; this prevents an adequate balance between institutional continuity and renewal. Large segments of public higher education have experienced serious deterioration in a process accompanied by growth of the private sector in education, which covers a portion of the excess demand with a bias toward the commercial sciences and less emphasis on engineering and the exact and experimental sciences. This has direct consequences for R&D, which is carried out mainly in public universities and related research centers. Most programs for the promotion of R&D have been reactive, serving to promote and strengthen what already exists, but unable to give a radical lead in the attainment of objectives or the type of actors involved and their ways of working. Strong inertial trends prevail in the fragmented interests of the scientific communities, without their becoming articulated in broader strategies involving varied and dynamic partnerships. Needless to say, this indicates the lack of density of the socioeconomic tissue.

The number of linkage mechanisms in the academic world and the science and technology public sector has multiplied in the 1990s. But support institutions and policies will not be effective unless there is a significant increase in private investment in R&D without a reduction of already limited public funds. A continuous supportive government presence is needed, but should be focused on what only it can do in the different fronts linked to the industrial and technological processes, while leaving direct production and technology transfer to the private sector.

Technological activity carried out through cooperative schemes is an option increasingly used everywhere, because it facilitates the speed of technical progress and market redistribution. The various forms of partnership between firms, and between these and research institutions and universities, allow some current obstacles to the establishment of innovation capabilities to be overcome. In the three countries discussed here, this kind of interaction is very new. Often, the entrepreneur does not take advantage of results generated by potential partners due to a lack of knowledge of the existence of relevant products and processes for the firm. It is therefore indispensable to multiply the channels and forms of access to technological information and business opportunities available to the entrepreneurial segment.

Education ought to be revitalized at all levels, including not only the training of scientists, engineers, and the technical workforce, but also of managers and entrepreneurs—so that they may gain a better understanding of the importance of innovation and its main components—as well as shopfloor technicians and blue-collar workers who must have a higher level of schooling and skills for raising their flexibility and capacity to adapt to continuing technical change. Although there are valuable schemes in vocational training, especially ones provided by public institutions in close partnership with the private sector—such as Servcio Nacional de Aprendizaje in Colombia, Direccion General de Educacion Tecnologica Industrial in Mexico, and Instituto Nacional de Cooperacion Educativa in Venezuela—they are clearly insufficient. So far, it has not been possible to extend them more widely, for the role of the firms in this field should be much greater. Continuing education and training ought to be stimulated, recognizing that, particularly in scientific and technical fields, education must be a life-long activity.

Although some critics adhering to a narrowly technical and developmental view deplore the pretension of scientific leadership to publish internationally, as if such activity would distance them from domestic relevance, it may reasonably be argued that the change in publishing behavior from locally oriented media to international journals is necessary for a country's technological development. To benefit from worldwide technical and scientific developments, the local researcher must know and understand them; and, therefore, to some extent, contribute actively in those developments. In a global world, information and communication do not recognize national boundaries.

It should be stressed that the importance of supporting basic science in countries with small scientific communities is in the resulting externalities, for it allows access to the international pool of knowledge, skills, and information. When it is argued that the effort should be reoriented because an enormous reservoir of technical and scientific knowledge already exists, this does not mean to cease supporting the scientific and technical communities in those countries. On the contrary, given the level of complexity and sophistication of contemporary knowledge, today more than ever communities of researchers and engineers are needed who are well-versed in the most advanced knowledge and who may read and interpret results and guide strategic decisions of a technical nature.

The short-term focus that has prevailed in the privatization process brings uncertainty to the viability of the reforms aimed at saving and optimizing R&D capacities in the three countries. It is not clear whether the new industrial structures will stimulate the establishment of research facilities in small and medium-sized firms. It is unlikely that the numbers of scientific and technological personnel will grow much in the near future. For the same reasons, the capacity to train R&D staff in national systems will probably remain limited, unless there are deep changes in conception and structure. The numbers of students in key disciplines might remain equally limited.

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APPENDIX

Appendix table 1. Mexican graduate population by level, 1987-97

Year	Total		Specialization		Master		Doctorate	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1987	38,214	100.0	13,084	34.2	23,751	62.2	1,379	3.6
1988	39,505	100.0	13,526	34.2	24,676	62.5	1,303	3.3
1989	42,655	100.0	14,757	34.6	26,561	62.3	1,337	3.1
1990	43,965	100.0	15,675	35.7	26,946	61.3	1,344	3.0
1991	44,946	100.0	16,367	36.4	27,139	60.4	1,440	3.2
1992	47,539	100.0	17,576	37.0	28,332	59.6	1,631	3.4
1993	50,781	100.0	17,440	34.4	31,190	61.4	2,151	4.2
1994	54,910	100.0	17,613	32.1	34,203	62.3	3,094	5.6
1995	65,615	100.0	18,760	28.6	42,342	64.5	4,513	6.9
1996	75,392	100.0	20,852	27.6	49,356	65.5	5,184	6.9
1997	87,696	100.0	21,625	24.7	59,913	68.3	6,158	7.0

SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). *Anuario Estadístico. Población escolar de posgrado.* México, D.F.

Appendix table 2. Doctoral student population in Mexico by field, 1997

Field	1st Enrollment & re-enrollment			Graduates 1996		
	Total	Men	Women	Total	Men	Women
Total	6,158	4,038	2,120	734	457	277
Agricultural sciences	420	326	94	48	35	13
Agronomy	270	209	61	29	23	6
Veterinary & zootechnics	150	117	33	19	12	7
Health sciences	456	240	216	103	67	36
Biomedicine	118	54	64	31	16	15
Pharmacology	25	12	13	4	2	2
Medicine	91	68	23	41	32	9
Dentistry	19	10	9	1	0	1
Other specialties	203	96	107	26	17	9
Basic & natural sciences	1,621	1,127	494	123	84	39
Astronomy	14	7	7	1	0	1
Biophysics	4	4	0	0	0	0
Biology	522	315	207	48	33	15
Sciences	15	12	3	0	0	0
Biochemistry	13	12	1	0	0	0
Chemistry	291	181	110	14	6	8
Earth sciences	97	76	21	3	0	3
Sea sciences	72	48	24	2	1	1
Ecology	67	41	26	6	2	4
Physics	413	345	68	39	34	5
Mathematics	113	86	27	10	8	2
Administration & social sciences	1,574	998	576	236	143	93
Administration	83	63	20	24	20	4
Anthropology & archeology	246	123	123	57	31	26
Political sciences	27	20	7	7	6	1
Social sciences	342	212	130	44	25	19
Law	478	340	138	62	38	24
Economy & development	158	124	34	9	7	2
Latin american studies	90	44	46	10	7	3
Geography	34	19	15	1	1	0
Taxes & finances	34	25	9	0	0	0
Psychology	66	20	46	19	6	13
International relations	16	8	8	3	2	1
Education & humanities	1,085	574	511	162	76	86
Education	668	370	298	50	32	18
Philosophy	79	53	26	15	8	7
History	206	98	108	57	24	22
Literature	102	43	59	28	10	18
Linguistics	30	10	20	12	2	10

See SOURCE at end of table.

Appendix table 2. Doctoral student population in Mexico by field, 1997 (Continued)

Field	1st Enrollment & re-enrollment			Graduates 1996		
	Total	Men	Women	Total	Men	Women
Engineering & technology	1,002	773	229	62	52	10
Architecture & design	112	76	36	7	7	0
Biotechnology	191	121	70	9	4	5
Sciences	172	131	41	5	5	0
Computer sciences	49	41	8	1	1	0
Ambiental engineering	6	3	3	0	0	0
Civil engineering	150	131	19	13	11	2
Electric engineering & electronics	175	162	13	12	12	0
Extractive eng., metal. & energy	39	30	9	8	5	3
Industrial engineering	22	16	6	6	6	0
Mechanical engineering	14	13	1	0	0	0
Chemical engineering	23	21	2	1	1	0
Planning	13	11	2	0	0	0
Nutrition technology	36	17	19	0	0	0

SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). *Anuario Estadístico,* 1997.

Appendix table 3. Master's student population in Mexico by field, 1997

Field	1st Enrollment & re-enrollment			Graduates 1996		
	Total	Men	Women	Total	Men	Women
Total	59,913	36,128	23,785	11,164	6,702	4,462
Agricultural sciences	1,368	1,032	336	431	347	84
Common cycle	15	9	6	0	0	0
Agronomy	786	610	176	271	224	47
Forestry development	69	54	15	22	15	7
Veterinary & zootechnics	498	359	139	138	108	30
Health sciences	2,032	1,007	1,025	536	263	273
Biomedicine	161	76	85	67	29	38
Nursing	39	2	37	32	2	30
Pharmacology	97	31	66	18	6	12
Medicine	445	257	188	74	49	25
Nutrition	35	17	18	27	11	16
Dentistry	143	72	71	38	18	20
Other specialties	446	206	240	96	52	44
Psychiatry	21	12	9	4	3	1
Public health	633	332	301	180	93	87
Natural & basic sciences	3,028	1,842	1,186	616	396	220
Astronomy	15	9	5	1	0	1
Biophysics	4	1	3	0	0	0
Biology	727	335	392	124	66	58
Biochemistry	105	52	53	8	3	5
Sciences	75	39	36	19	8	11
Chemistry	432	199	233	89	40	49
Earth sciences	244	205	39	37	32	5
Sea sciences	230	133	97	53	36	17
Ecology	197	109	88	31	15	16
Physics	623	490	133	190	149	41
Mathematics	377	270	107	64	47	17
Social & administration sciences	29,469	18,204	11,265	4,505	2,788	1,717
Administration	27	12	15	2,669	1,814	855
Anthropology & archeology	16,923	11,128	5,795	58	25	33
Archives & library sciences	171	87	84	4	3	1
Political sciences	72	22	50	86	51	35
Social sciences	603	324	279	180	90	90
Communication sciences	518	251	267	54	25	29
International trade	116	68	48	1	1	0
Accounting	510	299	211	19	10	9
Law	2,851	1,828	1,023	349	216	133
Economy & development	2,104	1,430	674	354	230	124
Latin american studies	169	80	89	21	12	9
Taxes & finances	2,425	1,623	802	246	166	80

See SOURCE at end of table.

Appendix table 3. Master's student population in Mexico by field, 1997 (Continued)

Field	1st Enrollment & re-enrollment			Graduates 1996		
	Total	Men	Women	Total	Men	Women
Psychology	2,248	640	1,608	398	102	296
Advertising	47	17	30	5	2	3
Industrial relations	98	50	48	0	0	0
International relations	54	25	29	3	2	1
Tourism	31	16	15	0	0	0
Sales & marketing	172	101	71	55	37	18
Education & humanities	13,792	6,253	7,539	3,051	1,380	1,671
Fine arts	265	107	158	50	24	26
Sports sciences	58	51	7	12	7	5
Education	10,455	4,716	5,739	2,053	916	1,137
Normal education	1,449	651	798	567	258	309
Philosophy	453	280	173	110	68	42
History	454	206	248	84	38	46
Humanities	99	37	62	34	16	18
Languages	12	5	7	21	5	16
Literature	438	154	284	82	31	51
Linguistics	109	46	63	38	17	21
Engineering & technology	10,224	7,790	2,434	2,025	1,528	497
Common cycle	12	7	5	0	0	0
Architecture & design	1,150	770	380	139	103	36
Biotechnology	324	174	150	96	43	53
Sciences	95	57	38	24	9	15
Computation sciences	1,976	1,478	498	461	351	110
Environmental engineering	497	332	165	119	71	48
Civil engineering	1,424	1,188	236	259	213	46
Electric engineering & electronics	1,116	992	124	240	211	29
Extraction engineering, metal.& energy	185	151	34	34	27	7
Physics engineering	15	15	0	4	4	0
Hydraulic engineering	122	96	26	43	33	10
Industrial engineering	1,404	1,114	290	227	185	42
Mechanical engineering	513	491	22	113	107	6
Fishing engineering	38	26	12	17	11	6
Chemical engineering	416	289	127	73	55	18
Transports engineering	74	57	17	34	32	2
Planning	592	441	151	55	38	17
Nutrition engineering	251	96	155	87	35	52
Wood technology	20	16	4	0	0	0

SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). *Anuario Estadístico,* 1997.

Appendix table 4. Specialization student population in Mexico by field, 1997

Field	1st Enrollment & re-enrollment			Graduates 1996		
	Total	Men	Women	Total	Men	Women
Total	21,625	11,895	9,730	8,305	4,451	3,854
Agricultural sciences	82	69	13	53	48	5
Agronomy	16	13	3	24	23	1
Veterinary & zootechnics	66	56	10	29	25	4
Health sciences	12,391	7,196	5,195	3,812	2,194	1,618
Surgery	811	682	129	193	179	14
Nursing	181	11	170	166	9	157
Pharmacology	22	8	14	0	0	0
Medicine	6,714	4,008	2,706	1,940	1,187	753
Nutrition	17	8	9	0	0	0
Dentistry	988	419	569	411	180	231
Other specialties[a]	3,310	1,868	1,442	980	570	410
Psychiatry	66	33	33	29	19	10
Radiology	160	87	73	44	27	17
Public health	122	72	50	49	23	26
Natural & basic sciences	168	91	77	59	31	28
Biology	17	12	5	10	8	2
Biochemistry	31	9	22	12	3	9
Chemistry	28	20	8	16	9	7
Earth sciences	8	5	3	7	5	2
Mathematics	84	45	39	14	6	8
Social & administration sciences	6,117	3,013	3,104	2,946	1,481	1,465
Administration	1,083	542	541	608	290	318
Political sciences	0	0	0	25	23	2
Social sciences	101	12	89	7	5	2
Communication sciences	30	5	25	7	1	6
International trade	134	71	63	92	60	32
Accounting	84	55	29	12	7	5
Law	1,359	715	644	756	404	352
Economy & development	47	26	21	29	13	16
Geography	0	0	0	8	7	1
Taxes & finances	2,231	1,232	999	912	519	393
Psychology	558	150	408	240	55	185
Advertising	55	12	43	22	0	22
Sales & marketing	435	193	242	228	97	131
Education & humanities	1,513	618	895	704	235	469
Education	1,467	588	879	658	221	437
Philosophy	0	0	0	3	2	1
History	35	25	10	9	5	4
Languages	1	0	1	6	1	5
Literature	10	5	5	28	6	22

See explanatory information and SOURCE at end of table.

Appendix table 4. Specialization student population in Mexico by field, 1997 (Continued)

Field	1st Enrollment & Re-enrollment			Graduates 1996		
	Total	Men	Women	Total	Men	Women
Engineering & technology	1,354	908	446	731	462	269
Architecture & design	96	54	42	34	14	20
Biotechnology	8	6	2	9	3	6
Computation sciences	202	31	71	26	15	11
Environmental engineering	98	72	26	60	41	19
Civil engineering	145	125	20	73	66	7
Electric engineering & electronics	34	27	7	3	3	0
Extraction engineering, metal. & energy	42	37	5	14	14	0
Hydraulic engineering	13	13	0	14	13	1
Industrial engineering	591	362	229	482	284	198
Fishing engineering	44	42	2	0	0	0
Textile engineering	12	7	5	9	5	4
Nutrition engineering	64	27	37	7	4	3
Wood technology	5	5	0	0	0	0

[a] 63 Specialties

SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior (ANUIES). *Anuario Estadístico,* 1997.

Appendix table 5. Graduates by level of study, Mexico, 1984-96

Level	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total	6,634	7,047	6,896	7,869	9,916	11,159	9,885	11,548	12,097	12,060	13,632	18,291	16,276
Basic & natural sciences	268	390	324	561	382	347	618	615	536	658	802	863	798
Agricultural sciences	192	217	245	340	250	377	323	324	317	387	494	472	532
Engineering	864	1,018	862	1,227	1,033	836	1,168	1,318	1,445	1,490	2,112	2,603	2,818
Health	1,813	1,913	1,896	2,027	4,503	5,286	3,807	4,211	4,035	3,110	3,024	4,109	4,451
Social sciences	3,497	3,509	3,569	3,714	3,748	3,313	3,969	5,080	5,764	6,415	7,200	10,244	7,677
Specialization	2,749	2,793	3,036	2,939	2,939	5,553	4,525	5,835	6,035	5,616	5,963	7,764	7,601
Basic & natural sciences	25	18	11	69	75	26	47	47	51	110	114	123	59
Agricultural sciences	19	42	72	47	47	43	25	68	53	106	116	79	53
Engineering	195	239	218	226	226	270	198	268	409	463	727	934	731
Health	1,535	1,622	1,572	1,657	1,657	4,133	3,538	3,931	3,680	2,814	2,609	3,517	3,812
Social sciences	975	872	1,163	940	940	1,012	717	1,521	1,842	2,123	2,397	3,111	2,946
Master's	3,640	4,077	3,704	4,758	4,185	4,401	5,091	5,475	5,749	6,092	7,181	10,008	8,113
Basic & natural sciences	231	343	285	448	280	296	487	499	405	465	568	633	616
Agricultural sciences	170	173	164	290	184	328	294	253	255	276	368	373	431
Engineering	669	776	642	994	760	702	962	1,039	1,009	995	1,345	1,614	2,025
Health	268	270	319	340	338	262	234	239	319	254	362	533	536
Social sciences	2,302	2,515	2,294	2,686	2,623	2,813	3,114	3,445	3,761	4,102	4,538	6,855	4,505
Doctorate	245	177	156	172	178	204	269	238	313	352	488	519	572
Basic & natural sciences	12	29	28	44	27	25	84	69	80	83	120	107	123
Agricultural sciences	3	2	9	3	3	6	4	3	9	5	10	20	48
Engineering	0	3	2	7	3	3	8	11	27	32	40	55	62
Health	10	21	5	30	32	48	35	41	36	42	53	59	103
Social sciences	220	122	112	88	113	122	138	114	161	190	265	278	236

SOURCE: Asociacíon Nacional de Univeridades e Instituciones de Educación Superior ANUIES, *Anuarios Estadísticos de Posgrado,* 1985-96.

Appendix table 6. Statistical profile of U.S. doctorate recipients from Mexico, by major field of doctorate, 1988-96

Item	Total all fields		Total S&E	Physical sci.	Earth/ atmos/ ocean sci.	Mathematics	Computer/ info. sci.	Engineering	Bio. sci.	Agric. sci.	Psych/ social sci.	Non-S&E	Humanities	Education	Health sci.	Prof/ other fields
Total Ph.D.s[a]	-	1.4	1.1	102.0	61.0	68.0	26.0	238.0	230.0	198.0	203.0	233.0	91.0	63.0	41.0	38.0
Men	%	80.7	83.3	88.2	93.4	92.6	100.0	92.0	70.9	88.9	70.9	68.2	65.9	58.7	68.3	89.6
Women	%	19.3	16.7	11.8	6.6	7.4	0.0	8.0	29.1	11.1	29.1	31.8	34.1	41.3	31.7	10.6
Permanent visa	%	18.0	15.7	15.7	19.7	16.2	16.4	13.0	13.9	15.7	19.7	28.8	38.5	23.8	19.6	23.7
Temporary visa	%	82.1	84.3	84.3	80.3	83.8	84.6	87.0	86.1	84.3	80.3	71.2	61.5	76.2	80.5	76.3
Married	%	65.6	65.9	54.9	63.9	61.8	53.8	70.2	63.9	81.3	57.1	63.5	57.1	65.1	68.3	71.1
Not married	%	30.0	29.6	42.2	29.5	32.4	38.5	26.9	33.0	13.1	36.5	32.2	39.6	30.2	25.8	23.7
Unknown	%	4.5	4.5	2.9	5.6	5.9	7.7	2.9	3.0	5.6	6.4	4.3	3.3	4.8	4.9	5.3
Median age at Ph.D.	Yrs.	34.5	34.0	31.8	35.5	32.3	32.5	33.2	33.7	36.0	35.2	36.3	36.2	37.7	34.8	36.2
Percent with dependents	%	60.6	61.0	52.0	62.3	67.4	60.0	63.4	56.5	81.3	50.2	58.4	52.7	54.0	63.4	73.7
Sources of support[b]																
Personal	%	46.9	43.0	40.2	32.8	27.9	60.0	46.6	39.6	38.4	66.7	65.7	78.0	54.0	53.7	68.4
Foreign government	%	45.0	48.8	31.4	41.0	48.5	57.7	46.6	50.4	70.2	38.4	26.6	11.0	36.5	51.2	21.1
University	%	77.8	78.4	94.1	73.8	89.7	76.9	85.7	77.4	58.6	80.3	74.7	84.6	58.7	73.2	78.9
Technology assistant	%	44.0	42.5	68.6	32.8	70.6	42.3	45.8	34.3	15.2	54.7	61.5	76.9	30.2	22.0	57.9
Research assistant	%	48.9	52.9	80.4	67.2	30.9	50.0	66.4	50.9	48.0	34.0	29.2	15.4	25.4	63.4	31.6
Other university	%	22.5	21.5	17.6	18.0	25.0	30.8	17.2	21.7	14.1	34.0	27.5	38.5	23.8	17.1	18.4
Other	%	21.9	20.9	13.7	18.0	10.3	19.2	14.3	22.2	14.6	41.4	27.0	16.5	34.9	29.3	36.8
Unknown	%	3.8	3.9	2.9	8.2	2.9	3.8	3.4	3.0	3.5	5.4	3.4	1.1	3.2	4.9	7.9
Median time lapse from baccalaureate to Ph.D.																
Total time	Yrs.	10.3	9.9	8.6	11.5	8.1	8.9	10.0	9.1	11.8	10.1	12.0	10.0	13.3	12.4	14.0
Registered time	Yrs.	6.5	6.4	6.8	7.3	5.8	5.4	6.4	6.5	5.8	6.8	7.3	7.3	7.0	8.4	7.3
Planned location after Ph.D.																
Permanent visas	%	244.0	177.0	16.0	12.0	11.0	4.0	31.0	32.0	31.0	40.0	67.0	35.0	15.0	8.0	9.0
U.S. total	%	71.3	68.9	81.3	58.3	81.8	D	67.7	75.0	48.4	75.0	77.6	85.7	73.3	62.6	66.7
Study	%	26.4	34.4	38.5	42.9	44.4	D	33.3	54.2	13.3	26.7	7.7	10.0	9.1	0.0	0.0
Employment	%	70.1	62.3	61.5	57.1	55.6	D	61.9	33.3	86.7	73.3	88.5	83.3	90.9	100.0	100.0
Unknown	%	3.5	3.3	0.0	0.0	0.0	D	4.8	12.5	0.0	0.0	3.8	6.7	0.0	0.0	0.0
Non-U.S.	%	18.9	22.0	12.6	33.3	18.2	D	12.9	18.8	48.4	12.5	10.4	8.6	13.3	25.0	0.0
Unknown location	%	9.8	9.0	6.3	8.3	0.0	D	19.4	6.3	3.2	12.6	11.9	5.7	13.3	12.5	33.3

See explanatory information and SOURCE at end of table.

Appendix table 6. Statistical profile of U.S. doctorate recipients from Mexico, by major field of doctorate, 1988-96 (Continued)

Item	Total all fields		Total S&E	Physical sci.	Earth/ atmos/ ocean sci.	Mathematics	Computer/ info. sci.	Engineering	Bio. sci.	Agric. sci.	Psych/ social sci.	Non-S&E	Humanities	Education	Health sci.	Prof/ other fields
Temporary visas	%	1.1	949.0	86.0	49.0	57.0	22.0	207.0	198.0	167.0	163.0	166.0	56.0	48.0	33.0	29.0
U.S. total	%	30.9	31.1	55.8	26.5	22.8	50.0	39.1	35.4	12.0	23.9	29.5	37.5	20.8	33.3	24.1
Study	%	54.1	59.7	79.2	69.2	46.2	18.2	46.9	92.9	50.0	20.5	20.4	9.6	20.0	54.6	0.0
Employment	%	44.8	39.0	20.8	23.1	53.8	81.8	53.1	5.7	50.0	74.4	79.5	90.5	80.0	45.5	100.0
Unknown	%	1.2	1.4	0.0	7.7	0.0	0.0	0.0	1.4	0.0	5.1	0.0	0.0	0.0	0.0	0.0
Non-U.S.	%	61.2	61.4	40.7	65.3	70.2	40.9	49.3	61.1	77.8	69.9	59.6	55.4	68.8	54.5	58.6
Unknown location	%	8.0	7.5	3.5	8.2	7.0	9.1	11.6	3.5	10.2	6.1	10.8	7.1	10.4	12.1	17.2
Planned location in the U.S. after Ph.D.	n	518	417	51	20	22	14	102	94	35	69	101	51	21	16	13
Definite postdoc. study	%	28.8	33.8	47.5	35.0	22.7	14.3	23.5	62.8	22.9	10.1	7.9	5.9	9.5	18.8	0.0
Definite employment	%	33.8	30.2	14.8	20.0	50.0	42.9	43.1	7.4	34.3	47.8	48.5	54.9	28.6	31.3	76.9
Seeking postdoc. study	%	16.0	18.5	23.0	25.0	22.7	0.0	20.6	20.0	11.4	13.0	5.9	3.9	4.8	18.8	0.0
Seeking employment	%	19.5	15.6	14.8	15.0	4.5	42.9	11.8	5.3	31.4	26.1	35.6	31.4	57.1	31.3	23.1
Postdoc. plans unknown	%	1.9	1.9	0.0	5.0	0.0	0.0	1.0	4.3	0.0	2.9	2.0	3.9	0.0	0.0	0.0
Definite employment plans in U.S. after Ph.D.	n	175	126	9	4	11	6	44	7	12	33	49	28	6	5	10
Primary work activity																
R&D	%	45.1	53.2	88.9	D	18.2	100.0	56.8	42.9	83.3	33.3	24.5	14.3	50.0	D	20.0
Teaching	%	35.4	27.0	11.1	D	72.7	0.0	20.5	28.6	0.0	42.4	57.1	60.7	50.0	D	70.0
Administrative	%	2.9	1.6	0.0	D	0.0	0.0	2.3	0.0	0.0	3.0	6.1	10.7	0.0	D	0.0
Professional services	%	5.7	7.9	0.0	D	9.1	0.0	9.1	14.3	8.3	6.1	0.0	0.0	0.0	D	0.0
Other	%	1.7	2.4	0.0	D	0.0	0.0	2.3	14.3	0.0	3.0	0.0	0.0	0.0	D	0.0
Unknown	%	9.1	7.9	0.0	D	0.0	0.0	9.1	0.0	8.3	12.1	12.2	14.3	0.0	D	10.0
Type of employer																
Educ. institution[c]	%	59.4	49.2	11.1	D	90.9	16.7	43.2	42.9	41.7	56.7	85.7	85.7	100.0	D	90.0
Industry/Business	%	29.7	38.9	66.7	D	9.1	83.3	52.3	42.9	50.0	6.1	6.1	7.1	0.0	D	0.0
Government	%	4.0	5.6	11.1	D	0.0	0.0	4.5	0.0	8.3	9.1	0.0	0.0	0.0	D	0.0
Non-profit	%	1.7	0.8	11.1	D	0.0	0.0	0.0	0.0	0.0	0.0	4.1	3.6	0.0	D	10.0
Other and unknown	%	5.1	5.6	0.0	D	0.0	0.0	0.0	14.3	0.0	18.2	4.1	3.6	0.0	D	0.0

[a] This table includes all citizens of Mexico who indicated a visa status (permanent of temporary visa). Those with unknown visa status are not included.

[b] In this table a recipient counts once in each source category from which he or she received support. Since students indicate multiple sources of support, the vertical percentages sum to more than 100 percent. "Personal" includes a recipient's own eamings, family support, and loans. Federal research assistants are aggregated with university research assistants.

[c] Includes 2-year and 4-year colleges and universities, medical schools, and elementary/secondary schools.

KEY: D = Data withheld to avoid potential disclosure of confidential information.

SOURCE: National Science Foundation/Division of Science Resources Studies, *Survey of Eamed Doctorates.*

Appendix table 7. Fellowships administered by CONACYT, 1980-96

Year	Fellowships		
	Total	National	Foreign
1980	4,618	3,049	1,569
1981	4,340	2,309	2,031
1982	1,801	826	975
1983	2,540	2,072	468
1984	2,033	1,611	422
1985	2,608	2,032	576
1986	1,843	1,468	375
1987	2,220	1,822	398
1988	2,235	1,791	444
1989	1,677	1,368	309
1990	2,135	1,660	475
1991	5,570	4,181	1,389
1992	6,665	5,103	1,562
1993	9,492	6,988	2,504
1994	11,703	9,170	2,533
1995	16,200	12,840	3,360
1996/p	18,079	14,333	3,746

KEY: /p = Preliminary figures

SOURCE: National Council of Science and Technology Studies (CONACYT), Mexico.

Appendix table 8. Fellowships administered by CONACYT by study level, 1980-96

Year	Total	Master's	Doctorate	Postdoctorate	Other[a]
1980	4,618	2,138	311	9	2,160
1981	4,340	1,677	368	23	2,272
1982	1,801	377	88	3	1,333
1983	2,540	1,481	319	20	720
1984	2,033	1,135	303	19	576
1985	2,608	1,256	364	14	974
1986	1,843	821	268	12	742
1987	2,220	1,083	317	11	809
1988	2,235	1,006	351	21	857
1989	1,677	873	286	19	499
1990	2,135	1,142	453	17	523
1991	5,570	3,448	1,749	22	351
1992	6,665	4,412	2,184	13	56
1993	9,492	6,534	2,569	43	346
1994	11,703	8,056	3,167	53	427
1995	16,200	11,776	4,424	0	0
1996/p	18,079	12,479	5,269	0	331

[a] Includes specialization scholarships, interchange, actualization, language, technical training, and special projects. Data are preliminary.

KEY: /p = Preliminary figures

SOURCE: National Council of Science and Technology Studies (CONACYT), Mexico.

Appendix table 9. The 50 universities in greatest demand by CONACYT fellowship-holders

University	Country
1. The University of Arizona	United States
2. Harvard University	United States
3. Universidad Complutense de Madrid	Spain
4. Stanford University	United States
5. University of Texas at Austin	United States
6. Texas A&M	United States
7. Cornell University	United States
8. Columbia University	United States
9. University of Manchester Institute of S&T	United Kingdom
10. University of Warwick	United Kingdom
11. MIT	United States
12. New Mexico State University	United States
13. University of Essex	United Kingdom
14. Universidad Autónoma de Barcelona	Spain
15. Imperial College of S/T and Medicine	United Kingdom
16. Georgetown University	United States
17. Universidad Politécnica de Cataluña	Spain
18. U.London the London School of Econ. & Pol.Science	United Kingdom
19. University of Michigan	United States
20. UCLA	United States
21. UC Berkeley	United States
22. University of Illinois at Urbana Champaign	United States
23. UC Davis	United States
24. University of Pennsylvania	United States
25. New York University	United States
26. Northwestern University	United States
27. Universidad de Barcelona	Spain
28. University of McGill	Canada
29. Yale University	United States
30. University of Edinburough	United Kingdom
31. University of Cambridge	United Kingdom
32. University of Sheffield	United Kingdom
33. University of Oxford	United Kingdom
34. University of Reading	United Kingdom
35. University of Sussex	United Kingdom
36. University of Toronto	Canada
37. University College London	United Kingdom
38. Universite Pantheon Sorbonne-Paris I	France
39. University of Southampton	United Kingdom
40. Universidad de Salamanca	Spain
41. Universidad Autónoma de Madrid	Spain
42. University of British Columbia	Canada
43. University of Laval	Canada
44. Institut National Polytechnique de Grenoble	France
45. Ecole de Hautes Etudes en Sciences Sociales	France
46. Institut National Polytechnique de Toulouse	France
47. Université Pierre et Marie-Curie-Paris VI	France
48. Universidad Politécnica de Madrid	Spain
49. Université de Paris Sud Paris XI	France
50. Université Paris VI	France

SOURCE: National Council of Science and Technology Studies (CONACYT), *Programa de CyT 1995-2000,* Mexico.

Appendix table 10. Estimated cost of fellowships in Colombia and abroad, 1998

	Maintenance	Enrollment Fees	Pasantía[a]	Total
Abroad	1,100 x 48 = 52,800	6,000 x 8 = 48,000		100,800
Colombia[b]	725 x 42 = 30,450	2,140 x 8 = 17,120	1,100 x 6 = 6,600	54,170

a Visit to a foreign university.

b For the calculation of the value of a scholarship in Colombia, an exchange rate of 1,400/dollar and a monthly maintenance allowance equivalent to five minimum salaries was used. For domestic fees, it is assumed that the value in constant pesos is a little less than half the cost in foreign prestigious universities. The costs of travel, installation, books, computer, etc., cancel each other, for the domestic scholarship incudes a pasantía of some 6 months in a foreign university.

SOURCE: The Columbian Institute for the Development of Science & Technology (COLCIENCIAS), Comité Externo de Asesoramiento y Seguimiento - CEAS, 1998.

Appendix table 11. FUNDAYACUCHO educational loans and fellowships, 1990-96

Year	Total	Venezuela	Abroad
1990	577	398	179
1991	863	367	496
1992	400	157	243
1993	712	146	566
1994	541	157	384
1995	321	122	199
1996	614	194	420

SOURCE: Gran Mariscal de Ayacucho Foundation (FUNDAYACUCHO).

Appendix table 12. Fellowships by the UVC Science & Humanities Development Council by level, 1958-96

Level	Total	1958-66	1967-76	1977-86	1987-96
Total	603	24	124	284	171
Specialization	118	23	38	25	32
Master's	187	0	39	99	49
Doctorate	292	1	47	155	88
Postdoctorate	1	0	0	0	1
Research	5	0	0	5	1

SOURCE: Science & Humanities Development Council (CDCH) and the Central University of Venezuela (UCV).

Appendix table 13. Fellowships by the UVC Science & Humanities Development Council (CDCH) by faculty, 1958-96

Faculty	Total		1958-66	1967-76	1977-86	1987-96
Total	603	(100.0)	24 (4.0)	127 (21.1)	286 (47.4)	166 (27.5)
Agronomy	94	(15.6)	1	34	41	18
Archeology & urbanism	18	(3.0)	1	2	8	7
Sciences	152	(25.2)	2	38	68	44
Economic science	41	(6.8)	5	4	18	14
Juridical science	4	(0.7)	0	1	1	2
Veterinary	28	(4.6)	2	1	22	3
Pharmacy	16	(2.7)	0	2	12	2
Humanities & education	69	(1.4)	3	8	30	28
Engineering	57	(9.5)	4	14	28	11
Medicine	80	(13.3)	5	14	37	24
Odontology	44	(7.3)	1	9	21	13

SOURCE: Science & Humanities Development Council (CDCH) and the Central University of Venezuela (UCV).