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Ruchliwość pracowników naukowych w latach 1994–1996

Warszawa 1997

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The Brain Drain from Sciences and Universities in Poland 1994-1996

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INTRODUCTION

It is already for the third time during the last few years that we present a report elaborated on the order of the State Committee for Scientific Research, concerning the mobility of the research scholars in Poland[1]. The analysis encompasses the time span of 16 years, the period sufficiently long for gaining relatively good knowledge on the phenomenon considered and its temporal course. Information concerning mobility of research scholars contained in the present and in the previous reports come from the mailing survey sent to all the scientific institutions in Poland, excepting art schools and military academies. The numbers of questionnaires filled out were as follows: in 1992—1003, in 1994—1043, and in 1997—1042. As it is known, such a mail survey does not ensure adequate representation of the respective population, and so the group reached may to some extent differ from the whole population. Still, the significant number of the questionnaires sent back (approximately 50%), as well as the inclusion of a relatively large group of persons (26,268, i.e. 25% of all those employed in science and the university sector) causes that the results obtained are quite reliable[2]. Alas, no technical possibilities exist of contacting directly in person all of the more than 2,000 scientific institutions in Poland[3]. The only solution ensuring acquisition of the almost certain information on the mobility of the research staff would be to include this phenomenon in the systematic

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[1]*Ucieczka mózgów ze szkolnictwa wyższego i nauki (Brain drain from the universities and science),* EUROREG, Warszawa 1992, and *Ucieczka mózgów z nauki i szkolnictwa wyższego w Polsce w latach 1992–1993 (Brain drain from science and the universities in Poland in the years 1992–1993),* EUROREG, Warszawa 1994.

[2]In 1992 the survey encompassed 28,497 research employees, and in 1994—30,588 such persons.

[3]For purposes of this study the definition of the scientific institution (entity) was used according to which the smallest separate organizational units of the universities, research institutes and the Polish Academy of Sciences were treated as the objects of analysis, and so the questionnaires were sent to laboratories and chairs, and to institutes, in cases when they were not broken down into smaller establishments. The basis for selection was constituted by the *Informator Nauki Polskiej (Directory of Polish Science).*

statistical reporting of the Central Statistical Office (GUS), as postulated by us anyway before. Application of the identical techniques of inquiry in the consecutive analyses, and the analogous questions appearing in the respective questionnaires guarantee comparability of results. Thus, in spite of the shortcomings of a mailed questionnaire survey the studies conducted bring sound knowledge on the mobility of the research staff.

The English language version of the report omits the chapter which contains a review of the primarily foreign literature on the brain drain phenomenon.

Warsaw, September 1997.

1. SCIENCE AND UNIVERSITIES IN THE MIDDLE OF 1990s

1.1. Financing of science and universities

The effectiveness of functioning and the general situation of the sphere of science and university education both depend upon the level of financing, mainly from the state budget, although other sources of funds appeared in Poland during 1990s as well. These other sources of funds do, however, still play a marginal role in the total of resources used for the conduct of research and the functioning of the education process. The state budget contributed, in relative terms, in a decreasing degree to financing of science and university education in the first half of 1990s. The share of expenditures on science declined from 2.5% in 1991 to 1.6% in 1995, and on the university education—from 2.7% to 2.4%, respectively[1] (Table 1.1). After multiple appeals of the scientific community and the alarming reports and analyses of the condition of the universities and the financial standing of the persons employed in research and higher education this share was finally increased in 1996 to 2.8%. For comparison, let us note that some other sectors of the budgetary (governmental) sector obtained in the same period an increasing share of expenditures. And so, for instance, the share of expenditure on state administration increased during the period 1991–1995 from 2.9% to 3.4%, and then to 3.6% in 1996, while expenditure on the justice and prosecution system, as well as public security, increased from 4.9% to 5.6%, and then to 6.1%.

It can therefore be stated that the competition for the means from the central budget was at the beginning of 1990s lost by science and universities to the advantage of the social needs deemed to be more acute. In other words: the current needs took the upper hand over the long term ones, or yet otherwise: the easily perceptible ones were given higher priority than those harder to grasp, since the latter require more time to surface

[1]Most of the statistical data, if not noted otherwise, come from the publications of GUS (Central Statistical Office), and especially from the serial statistical yearbooks and provincial statistical yearbooks (*Rocznik Statystyczny, Mały Rocznik Statystyczny, Roczniki Statystyczne Województw*), or are the results of own calculations performed on the basis of GUS data.

Table 1.1.

Shares of expenditures on science and universities in the state budgets in comparison with expenditures on some other public sectors in the years 1988–1997 (in % of total expenditures)

Sector[1]	1988[2]	1989[2]	1990[2]	1991	1992	1993	1994	1995	1996	1997[4]
Science	0.8	0.4	0.2	2.5	1.9	1.8	1.7	1.6	1.6	1.7
Universities	2.4	2.8	3.6	2.7	2.6	2.5	2.4	2.4	2.8	2.9
Education & upbringing	9.5	11.8	12.8	11.6	10.4	10.3	11.2	11.3	4.9[3]	5.0
Culture and arts	1.9	2.2	1.8	1.0	0.8	0.8	0.7	0.8	0.8	0.8
Health and social care	13.0	13.6	19.0	21.6	21.8	20.7	20.4	23.7	25.3	23.8
State administration	2.6	2.7	3.3	2.9	2.7	3.2	3.4	3.4	3.6	3.8
Justice and prosecution; public security	3.8	4.0	4.6	4.9	5.4	5.9	5.9	5.6	6.1	5.9

[1] Classification into sectors according to the KGN (Classification of National Economy);
[2] Concerns current expenditures from the state budget (thus excepting, in particular, the expenditures related to financing of investment projects and overhauls);
[3] As the primary schools started to be taken over by the communes on January 1st, 1994, the funds from the state budget meant for this purpose are also being transferred in the framework of the educational subsidy; all the primary schools were taken over by the communes as of January 1st, 1996;
[4] Planned expenditures.

with adequate force. These latter needs, of civilisational nature, are visible especially then, when a leap-like advance is being made in other countries. The widening gap which separates Poland from these other countries, cannot be bridged without systematic, adequately high outlays into science and the university system, none of which bring quick effects. It must be noted that the share of these expenditures in the Gross Domestic Product (GDP) decreased in the years 1991–1995 from 1.58% to 1.26% (Table 1.2). On the other hand, this takes place in spite of the declarations contained in numerous governmental documents concerning the necessity of catching up in terms of bringing the civilisational level of our country closer to the one of the highly developed countries[2]. We can add here for illustration purposes that the expenditures from public and private sources on the

[2]See, for instance, *Narodowa Strategia Integracji (National Integration Strategy)*, the European Integration Committee, Warszawa 1997; or *Strategia dla Polski (Strategy for Poland)*, Warszawa 1994. Attention should also be paid to *Założenia polityki proinnowacyjnej państwa (Prerequisites for the innovation-supporting policy of the state)*, a governmental document adopted by the Council of Ministers at its meeting of November 22nd, 1994 (KBN, Warszawa, November 1994), and *Preferowane kierunki badań naukowych i prac rozwojowych dla zwiększenia innowacyjności polskiej gospodarki (The preferred directions of research and development activities for the enhancement of innovativeness of Polish economy)*, KBN, Warszawa, January 1996.

Table 1.2.

Shares of expenditures from the state budget on science and universities in the Gross Domestic Product in the years 1991–1996 (in % of GDP)

Items	1991	1992	1993	1994	1995	1996
Science	0.76	0.64	0.57	0.55	0.50	0.52
Universities	0.82	0.88	0.82	0.78	0.76	.
Totals	1.58	1.52	1.39	1.33	1.26	.

universities alone constituted in 1992 in Denmark 2.0% of the GDP, in the Netherlands—1.8%, in Ireland and in Sweden—1.6%[3].

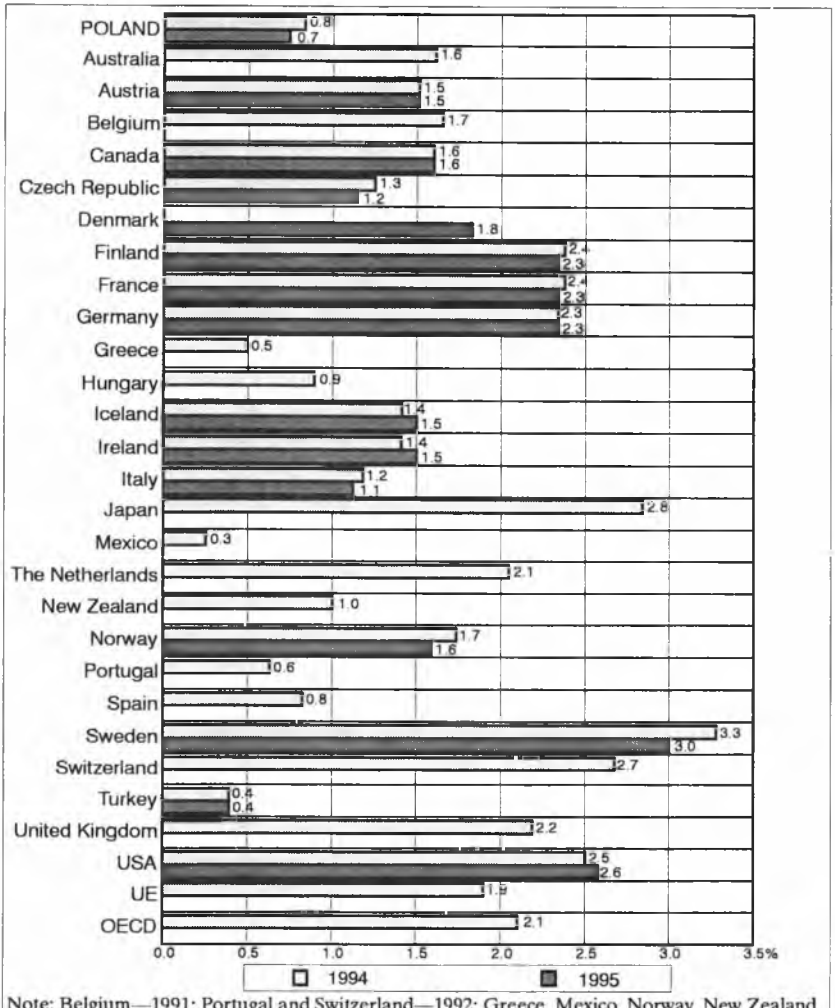
Given the so low value of the means disbursed from the state budget for science and universities, and the meagre support for these spheres from other sources, Poland takes a far place in terms of joint outlays into the R&D activity[4] expressed as shares of the GDP. In 1995 this share was 0.74% and was more than four times lower than in Sweden, more than three times lower than in Germany, Finland or France, and more than two times lower than in Austria, Ireland or Norway. In comparison with the countries of the European Union Poland disbursed for the research-and-development activity in 1994 (in terms of share in the GDP) 2.3 times less, and in comparison with the OECD countries—2.6 times less. A similar level of relative expenditures considered is observed in Spain and Hungary (see Fig. 1, after Kozłowski, 1995; Moszkowska, 1995[5]). It can be noted that Poland is not the only country where this level decreased between 1994 and 1995, but as a rule this happened in the highly developed countries, such as Sweden, Germany or France.

The distance considered gets even more visible if we compare the outlays on research and development per 1 inhabitant. Among the OECD countries the respective numbers were lower than in Poland (46 USD per

[3]See *Finanse szkół wyższych w 1995 r. (Financing of the universities in 1995)*, "Informacje i opracowania statystyczne", GUS, Warszawa 1996, p. 18.

[4]The R&D sphere concerns, generally speaking, the scientific and the research-and-development activities conducted in: 1) scientific research units, which encompass the institutions belonging to the Polish Academy of Sciences as well as the universities; 2) research-and-development units, such as research institutes, research-and-development centers, central laboratories (of various broader administration institutions), etc.; 3) enterprises, involved in the R&D activity, to the extent they do conduct this activity; and 4) other entities, such as: the scientific service units (like scientific libraries), science foundations, as well as other foundations—to the extent they conduct respective activities. The outlays into R&D do not include the means disbursed within the same units for other purposes, e.g. for education at the universities. This definition follows the one proposed by B. Rejn, Z. Żółkiewski (1995). We refer to this publication—unless otherwise indicated—in all the fragments of our present report concerning financing of the R&D activity.

[5]List of references is provided in the Polish language version of the report.



Note: Belgium—1991; Portugal and Switzerland—1992; Greece, Mexico, Norway, New Zealand and Sweden—1994; for some countries no data are available for 1995; Japan—reestimated data; USA and OECD—mostly without capital expenditures; Sweden—an underestimate; OECD countries without Luxembourg.

Source: B. Rejn, Z. Żółkiewski, *Rachunek satelitarny nauki 1994-1995 (The satellite account for science in 1994–1995)*, „Z Prac Zakładu Badań Statystyczno-Ekonomicznych", issue 246, ZBSE GUS & PAN, Warszawa 1997, p. 43.

Fig. 1. The shares of the expenditures on the R&D activity in the Gross Domestic Product of the OECD countries in the years 1994–1995

1 inhabitant) only in Turkey (19 USD) and Mexico (17 USD), and were slightly higher in Greece (53 USD) and Hungary (56 USD). In the United States, where the greatest amounts are disbursed on this kind of activities, the per capita indicator is 14 times higher than in Poland (Fig. 2).

Within the sphere considered the largest share from the state budget goes to the research-and-development units[6] (47–48% of total expenditures), followed by the public universities (approximately 33%) and the institutes of the Polish Academy of Sciences[7] (15–16%). Private university-type schools get from the state budget just a fraction of 1% of the total expenditures on the R&D activity (see Fig. 3).

The majority of the financial means at the disposal of universities is, however, meant for the education purposes or is acquired from educational activity. In 1995 these means constituted more than 80% of the total of revenues, and in the private (or, more precisely: non-public) schools, where teaching is the basic kind of activity, this share attained even 96% (see Table 1.3). The resources meant for the teaching activity in the state-run schools come first of all from the central budget (in 1995—80%), although in the recent period the share of tuition fees increased considerably (in 1995—11%), especially in the economic and pedagogical higher schools (almost 28% and more than 24%, respectively). The teaching activity of the non-public schools is based primarily upon tuition fees. The revenues from fees constituted in them in 1995 more than 90% of the total funds spent on teaching[8]

As mentioned previously, new sources of funds for the research and development activity, other than the state budget, appeared in 1990s in Poland, including first of all private agents, also foreign ones, as well as the self-governmental agents (whose contribution, though, is marginal). The joint share of these new sources in the total of spendings is, however, low,

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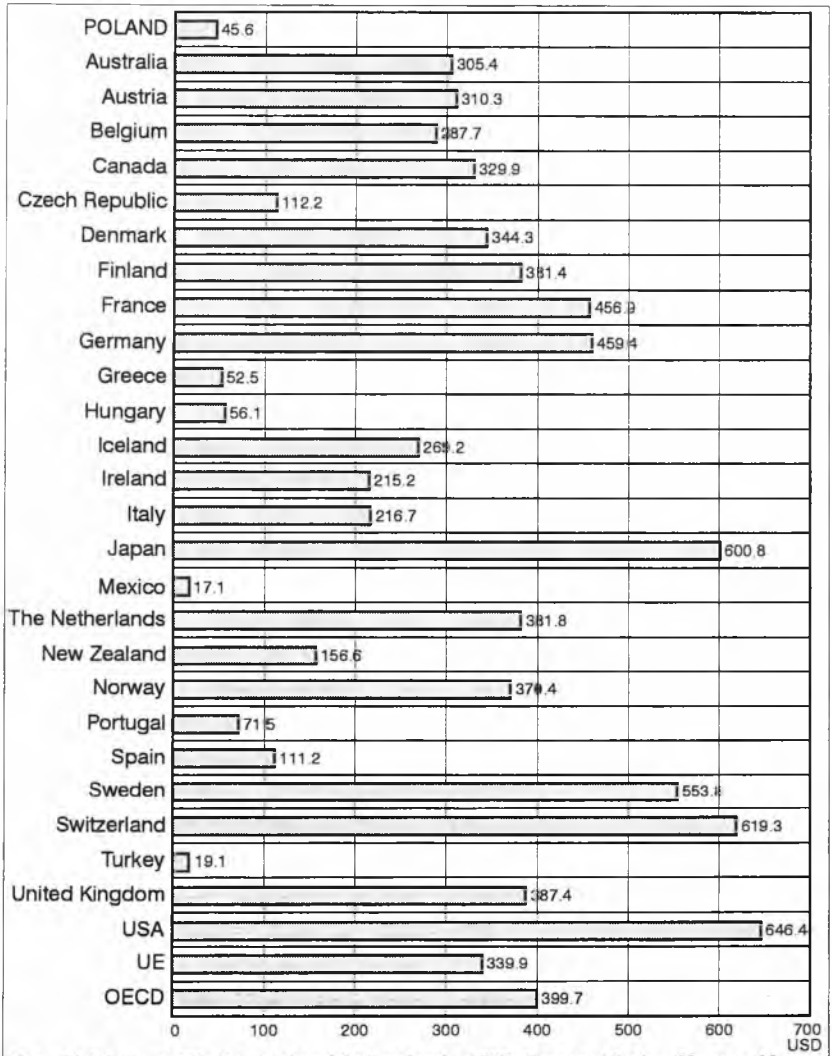
[6]*Ustawa o jednostkach badawczo-rozwojowych (Law on the research-and-development units),* "Rzeczpospolita", 15 July, 1997.

[7]*Ustawa z 25 kwietnia 1997 r. o Polskiej Akademii Nauk (Law of April 25th, 1997, on the Polish Academy of Sciences),* "Dziennik Ustaw", no. 75, item 469, Chapter 6: Finances of the Academy. Warszawa, 14 July, 1997.

[8]*Finanse szkół wyższych w 1995 r. (Financing of the universities in 1995),* op. cit., p. 26.

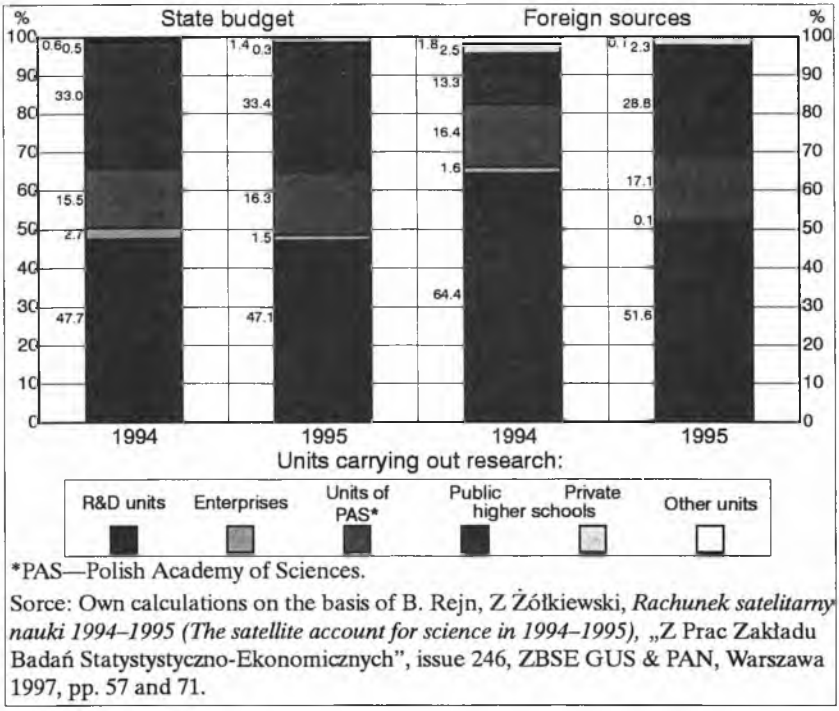
Here and throughout the whole text of the report the university sector is meant as encompassing all of the post-secondary schools, i.e. both the universities and the college-like establishments, ending with a definite professional and/or scientific title or degree. Further, since the formal name of "university" is given in Poland only some higher schools out of those which confer the master's degree, the distinction being based upon the level and scope of teaching, we will refer to them further on as "universities proper", though some of the other types of schools (e.g. the "universities of technology") may offer a similar quality of teaching [transl.].



Note: Belgium—1991; Portugal and Switzerland—1992; Greece, Mexico, Norway, New Zealand and Sweden—1994; for some countries no data are available for 1995; Japan—reestimated data; USA and OECD—mostly without capital expenditures; Sweden—an underestimate; OECD countries without Luxembourg.

Source: B. Rejn, Z. Żółkiewski, *Rachunek satelitarny nauki 1994-1995 (The satellite account for science in 1994–1995)*, „Z Prac Zakładu Badań Statystyczno-Ekonomicznych", issue 246, ZBSE GUS & PAN, Warszawa 1997, p. 43.

Fig. 2. Expenditures on R&D activity in OECD countries in 1994 *per capita* (in US dollars)



*PAS—Polish Academy of Sciences.

Sorce: Own calculations on the basis of B. Rejn, Z Żółkiewski, *Rachunek satelitarny nauki 1994–1995 (The satellite account for science in 1994–1995)*, „Z Prac Zakładu Badań Statystystyczno-Ekonomicznych", issue 246, ZBSE GUS & PAN, Warszawa 1997, pp. 57 and 71.

Fig. 3. Expenditures on R&D activity in Poland from the state budget and foreign sources in the years 1994–1995 according to types of units carrying out these activities, in %

and it oscillates between 3% and 4%, with the foreign sources contributing 1.3% of the totality of expenditures in 1994 and 1.7% in 1995. These foreign funds went again primarily to the research-and-development units (in 1994 they obtained more than 64% of these funds), and also to the institutions belonging to the Academy of Sciences (more than 16%). In the same year the public universities got only 13% of these funds, but already in the subsequent year their share increased to almost 30% (see Fig. 3). From among the disciplines of science the greatest amount of funds from foreign sources during the two years mentioned went to silvicultural, agricultural and veterinary sciences, taken together, followed by technical sciences. The funds spent for these groups of disciplines jointly from the foreign sources were almost twice as big as those spent on mathematical, physical, medical and social sciences together.

The structure of outlays on the source side is dominated, of course, by the State Committee for Scientific Research (in 1994—57.3%, in 1995—

59.9%), followed by the enterprises (24.9% and 24.3%, respectively). The Polish Academy of Sciences and the research-and-development units financed the R&D activity in the two years considered in only 14.6% and 12.0% of the respective totals for the country, while the universities —in only 1.5% and 1.8%, respectively (Fig. 4). These means were spent both on the research done within own institutions and the work commissioned with other bodies. The share of own funds of the respective institutions amounted in the period in question to some 23% on the average. The self-financing of research attains the highest level in the enterprises (80–85% of totality of the expenditures), while the universities conduct these activities mainly owing to external funds.

From the point of view of the breakdown according to the institutions carrying the research the greatest outlays are consumed in the research-and-development units (50.4% in 1994, and 47.9% in 1995), then in the universities (23.6% and 25.6%, respectively), and approximately the same amounts in the enterprises (13.8% and 13.0%) and in the units belonging to the Academy of Sciences (11.7% and 12.6%), see Rejn (1994, 1995).

* * *

Systematic lowering of the expenditures from the state budget on science and the university education in the first half of 1990s seems to be contrary to the aspirations of Poland in its wish of integration with the European Union and to the efforts undertaken against being pushed into the economic, social and civilisational periphery. The declarations on the necessity of investing in human capital do not find until now the adequate expression in actual facts. The extra-budgetary sources of funds for these two sectors of economy are not a satisfactory complement to the too low budgetary spendings. Although in the developed economies the tendency is observed of the increasing share of non-public funds in financing of the R&D activities, it seems that we cannot expect that such a tendency will soon take on in Poland the dimensions sufficient for an essential increase of total expenditures in terms of the share in the GDP.

Thus, the central budget must remain the fundamental source of financing during the years to come, and the respective share of expenditures should be increased systematically from year to year. The outlays into the university sector ought to grow, according to the opinion of the Socio-Economic Strategy Council, from the current 0.8% of the GDP to 2.5%, and outlays on science—from 0.5% to 2.0% (Smulska, 1997). One is left with hope that the improvement of the situation in 1996 will not be a single

Table 1.3.

Structure of revenues from operational activity* in the universities in 1995, according to school types

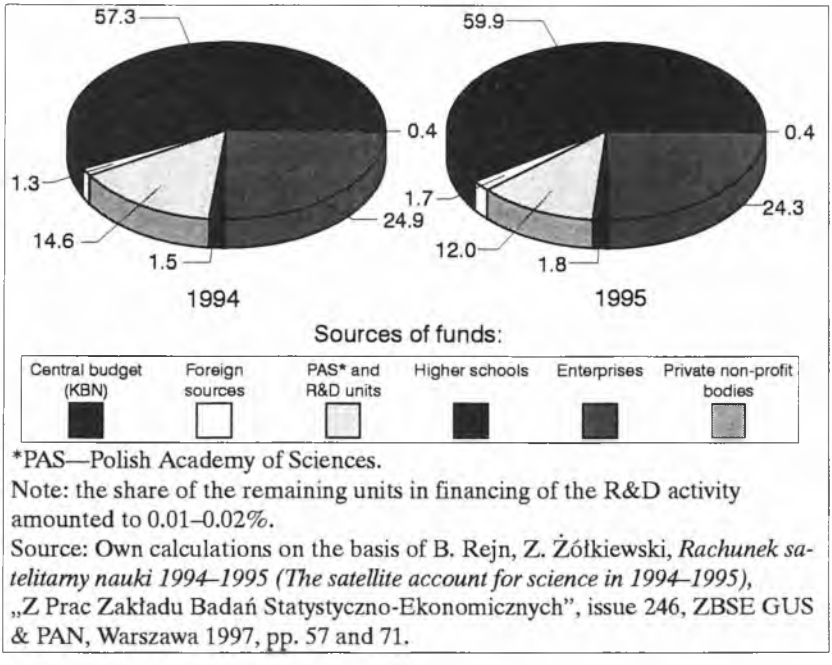
Types of schools	Revenues:				
	from teaching	from research	from economic activity**	other***	totals
Totals	80.4	16.5	1.1	1.7	100.0
State universities, with breakdown into:	79.7	17.1	1.1	1.7	100.0
Universities proper	86.0	12.5	0.3	1.2	100.0
Universities of technology	71.3	26.5	0.2	1.3	100.0
Agricultural academies	71.3	19.3	5.4	3.7	100.0
Academies of economics	92.5	7.1	x	0.3	100.0
Pedagogical higher schools	95.1	3.7	0.1	0.6	100.0
Academies of medicine	75.7	18.4	2.6	3.1	100.0
Sports and recreation academies	91.7	3.2	2.0	2.4	100.0
Non-public universities, with breakdown into:	96.0	0.6	0.1	3.2	100.0
Technical higher schools	78.9	5.7	x	15.4	100.0
Higher schools of economics	97.5	0.1	0.2	2.2	100.0
Pedagogical higher schools	99.0	x	x	1.0	100.0

*The notion of "revenues from operational activity" is introduced in order to make distinction from the "financial revenues", encompassing also the proceeds from sale of third party securities, shares, dividends, interest on credits granted etc.
**Including, in particular, revenues from sale of goods and services.
***Source: *Finanse szkół wyższych w 1995 r. (Financing of the universities in 1995)*, "Informacje i opracowania statystyczne", GUS, Warszawa 1996, p. 22.

event. As of now, namely, the financial situation still remains as the factor which "pushes away" the employees from the sphere here considered, and cannot be an "attracting" factor for the graduates of the universities, especially the best of them.

1.2. Organizational changes in the sphere of science and university

The period of transformation brought also the organizational and institutional changes in the sphere of science and university education. This occurred, first, due to the restructuring of units located within the so called governmental sector, which affected first of all the institutes of the Polish Academy of Sciences and the research-and-development bodies subordinated to this sector, and thereafter—due to the restructuring of the



*PAS—Polish Academy of Sciences.
Note: the share of the remaining units in financing of the R&D activity amounted to 0.01–0.02%.
Source: Own calculations on the basis of B. Rejn, Z. Żółkiewski, *Rachunek satelitarny nauki 1994–1995 (The satellite account for science in 1994–1995)*, „Z Prac Zakładu Badań Statystyczno-Ekonomicznych", issue 246, ZBSE GUS & PAN, Warszawa 1997, pp. 57 and 71.

Fig. 4. Expenditures on the R&D activity in Poland in the years 1994–1995 according to sources of funds, in %

research-and-development units belonging to the enterprise sector[9] (primarily in view of the incapacity of the enterprises to finance the respective units). The changes, which took place, were based upon the assumption of the necessity of adapting the R&D sphere to the new systemic framework of the state and to the requirements of market economy, to the extent to which this special sphere can be subject to market mechanism and respond to demands from the market[10].

[9]See also: *Rozporządzenie Rady Ministrów z dn. 17 grudnia 1996 w sprawie listy jednostek badawczo-rozwojowych, nad którymi sprawowanie nadzoru przejmują organy utworzone w ramach reformy funkcjonowania gospodarki i administracji publicznej (Order of the Council of Ministers of December 17th, 1996, on the list of research-and-development units whose supervision is taken over by the organs established in the framework of the reform of functioning of the economy and public administration)*, "Dziennik Ustaw", no. 157, item 789, Warszawa, 31 December 1996.

[10]See *Upowszechnianie i promocja nauki. Doświadczenia — dorobek — zamierzenia (Dissemination and promotion of science. Experiences—achievements—intentions)*, KBN—Ośrodek Przetwarzania Informacji, Warszawa 1997; *Katalog wystawców (Directory of exhibitors)*, "Oferta nauki '97", 69th International Poznań Fair, Poznań, 15–20 June 1997, KBN—Ośrodek Przetwarzania Informacji.

A reservation can be forwarded here that the above mentioned assumption is being implemented—often out of necessity—in a too far reaching degree. Commercial elements start to play an increasing role in the scientific, research-and-development as well as teaching activities. The cognitive aspect of the scientific procedures is being neglected, and this has an impact on, of course, first of all the fundamental research. This is occurring primarily due to the weakening of the protective functions of the state with respect to the R&D sphere. The equilibrium point between the two approaches—the market-oriented approach and the other one, resulting from the mission of cultivation of science—has namely not been found until now[11].

Within the framework of the massive transformations outlined the number of research-and-development units decreased between 1988 and 1995 by mere 15%, from 297 to 252, but employment in them dropped by more than half (see Table 1.4). This was first of all due to the reduction of the number of research-and development centers by ⅓ and to the fivefold decrease of employment in this group of institutions. Additionally, there was employment reduction by more or less half in the ministerial and branch research institutes. The structure of employment in the research-and-development units in the middle of 1990s is roughly as follows: 47% of employment is constituted by the research staff (uniquely persons with university education), slightly more than 30%—by technicians and similar support staff (persons with college-type and secondary education), and 23%—by the so called remaining staff (including blue collar personnel). In comparison with the end of the 1980s there has been a change in the proportions of employment in the direction of increase of the share of persons directly participating in the R&D work. The share of the remaining personnel decreased by 6–8 percentage points.

The number of the organizational entities belonging to the Polish Academy of Sciences has not undergone more important changes since the end of 1980s, though employment in them decreased by approximately ¼. The structure of this employment is currently as follows: approximately 60% of employees are constituted by the research staff, some 21%—by technicians, and some 19%—by the remaining personnel. In comparison with the end of 1980s the shifts which occurred went in the opposite di-

[11]Situation appears to exceed some of the prerequisites for the science and technology policy of the state. See *Założenia polityki naukowej i naukowo-technicznej państwa. Cele — priorytety — finansowanie. (Prerequisites for the science and technology policy of the state. Objectives—priorities—financing),* governmental document adopted by the Council of Ministers at the meeting of July 20th, 1993. KBN, Warszawa, July 1993.

rection to those in the research-and-development units, namely there has been an increase of the share of the support staff.

Let us also mention changes which took place in the so called "central laboratories" belonging to the class of research-and-development units. Their number decreased only from 13 to 10, but employment in them dropped several times over.

Table 1.4.

Numbers of organizational entities and employment in the institutions belonging to the Polish Academy of Sciences and the research-and-development units in the years 1988–1995

Years	Units of the Polish Academy of Sciences		Research-and-development units	
	no. of units*	employment**	no. of units*	employment**
1988	78	11,593	297	90,689
1989	81	11,339	297	80,610
1990	79	10,690	260	72,060
1991	79	10,949	296	65,837
1992	81	9,202	252	55,935
1993	82	8,782	310	49,568
1994	81	7,777	274	29,720
1995	81	8,089	252	30,900

* As of December 31st;
** 1988–1993: average values in the year, 1988–1990—full time employed, 1991–1993—full time employed and part-time employed expressed in full time equivalents; 1994–1995—full time equivalents of the person-years of research or research-and-development work.

Thus, restructuring of the scientific institutions (excepting universities) brought an important decrease of employment in these institutions. Consequently, a significant limitation of the scope of research work conducted had to follow, connected with abandonment of many research projects. Even if we assume that the process considered entailed elimination of the doubtless excess employment in many institutions, the quantitative losses borne seem to be too large. The related losses in terms of scientific substance may also turn out to be hard or impossible to compensate for. Scientific advance is namely due to the everyday work of many people in the numerous competing centers. The institutions here considered, subject to transformation processes, were not capable of creating conditions (nor were offered such conditions) for attracting to work in them the young and gifted university graduates.

As far as universities are concerned, they enjoy in the recent period a distinct quantitative growth. Between the academic years of 1990/91 and 1995/96 the number of higher schools (proper universities and college-type schools) increased from 112 to 179 (and in 1996/97 to 213). This

increase is mainly due to the numerous new non-public schools[12], whose number in the academic year 1995/96 was already 80, i.e. 45% of all the higher schools (Paciorek, 1997). Out of this number 10 schools belonged to the religious organizations, including the largest of such schools, the Catholic University of Lublin (KUL), with almost 13 thousand students. The remaining non-public higher schools were established by the international foundations, societies and private persons. The magnitudes of these schools vary considerably. The numbers of students taught range from a dozen, like in Jan Łaski Higher Theological Seminar in Warsaw (14 students at the end of 1995), through few dozens, like in the Higher School of Applied Arts in Szczecin (27 students), Higher School of Commerce in Cracow (61), Higher Seminary of the Seventh-Day Adventists in Podkowa Leśna (77), or the Higher School of Journalism in Warsaw (98), up to more than one thousand or even a couple thousands (KUL put aside, of course). These larger ones include, in particular: Higher School of Business and Administration in Warsaw (1892 students), Higher Pedagogical School of the Open Education Society in Warsaw (4102), Higher School of Finance and Management in Białystok (2490), Baltic School of Humanities in Koszalin (3483) or Masovian Higher School of Humanities and Pedagogics in Łowicz (4194)[13]. The majority of private schools are professionally oriented, providing three-year education cycle ending with the licentiate diploma. Only eight of these schools have the right to confer the master's title. In terms of education profile economic schools dominate (in 1995/96 there were 46 such schools), specializing primarily in management, marketing, finance and banking. In 1995/96 there also existed five technical and five pedagogical non-public schools (see Table 1.5).

The greatest number of the non-public high schools exist in Warsaw (27), while most of the other large academic centers host 5–6 such schools each (such is the situation in Cracow, Łódź, Poznań and in Upper Silesia). It is interesting that these schools appear also in the towns having had not even the slightest academic traditions (i.e. no branches of university-type schools nor consulting offices), like in Pułtusk, Leszno, Ostrołęka or Łowicz, and in such towns, where these traditions are very modest, like, e.g. Suwałki, Nowy Sącz or Tarnobrzeg. This results, in particular, from the positive climate, which exists in the small centers, for the upgrading

[12]The non-public schools are established on the basis of licenses granted by the Minister of National Education.

[13]*Szkoły wyższe w roku szkolnym 1995/96 (Higher schools in the academic year 1995/96)*, "Informacje i opracowania statystyczne", GUS, Warszawa 1996, pp. 4–9.

Table 1.5.

Numbers of higher schools according to school types in the academic years 1990/91 and 1995/96

Types of schools	Totals for 1990/91	Non-public schools in 1992/93	Totals for 1995/96	Non-public schools in 1995/96
Totals	112	18	179	80
Universities proper	11	1	12	1
Universities of technology	30	1	30	5
Academies of agriculture	9	—	9	—
Academies of economics	5	8	51	46
Higher pedagogical schools	10	1	14	5
Medical academies	12	—	11*	—
Naval schools	3	—	3	—
Sports and recreation academies	6	—	6	—
Fine arts schools	17	1	20	—
Theological higher schools	7	6**	11	9**
Other higher schools	2	—	12	11

* Since September 1st, 1993, the Medical Academy in Cracow was included in the Jagiellonian University as Collegium Medicum.

** Excepting the Academy of Catholic Theology and the Christian Theological Academy, formally treated as the state-run high schools.

of their cultural role, coupled with the opinion, expressed exactly by the leading circles of the medium-sized towns, of the necessity of increasing the number of students in the country[14].

In 1995/96 there were 99 state-run university-type schools in Poland[15], technical schools leading in terms of their number (25), followed by the artistic schools (20), medical academies and universities (11 of each of the two). One state university was added in the academic year 1994/95 due to the respective transformation of the Higher Pedagogical School in Opole, and presently there is a design for a university in Białystok, to be based upon the local branch of the University of Warsaw[16]. The state-run schools are also differentiated as to their magnitude—they range from a couple of hundreds of students (primarily artistic schools) to tens of thousands of students. University of Warsaw is the greatest higher school in Poland (50,187 students at the end of 1995), followed by Adam Mickiewicz University in Poznań (26,859), University of Łódź (24,522), Marie Skłodowska-

[14] *Potrzeby edukacyjne (Educational needs)*, op. cit., p. 21.

[15] The decrease of the number of the state-run higher schools was connected with the restructuring of the higher schools related to the national defense sector.

[16] There is also a proposal of changing the name of the Higher Agricultural-Pedagogical School in Siedlce to the Academy of Podlasie.

Curie University in Lublin (24,174) and Jagiellonian University in Cracow (19,958)[17].

The organizational transformations which took place within the state universities in 1990s had a two-fold character. First, they were connected with the more general systemic changes; entailing the liquidation or restructuring of the institutes, departments or chairs which dealt with the so called ideological sciences, especially in the economic schools, though not exclusively, and the establishment of numerous units (of varying rank), specializing in the new domains, especially connected with the functioning of the market economy. Second, they consisted in the broadening of the possibility of educating students within various extramural forms of study, related to the increased demand for education from the side of the young. The payment of tuition fees for such forms of study, which is in principle a new element in the functioning of the universities in Poland, at least in view of the widespread nature of this practice, allows the higher schools to admit larger numbers of students and to improve their budgetary situation.

In view of the changes which took place in the socio-economic reality of Poland in the 1990s it could be expected that the greatest organizational changes (as well as shifts in the subjects taught) would have occurred at the universities of economics[18]. A closer look at the five state universities of economics —the Main Trade School in Warsaw and the Academies of Economics in Katowice, Cracow, Poznań and Wrocław—allows to conclude that since the 1980s there has been an enormous partitioning of the respective disciplines into numerous specialized directions, entailing emergence of a significant number of institutes, departments and chairs, sometimes employing just a couple of persons. For obvious reasons, the units dealing with political economy disappeared, but this applies in principle also those specialized in planning. On the other hand, such disciplines appeared as: economic logistics, territorial self-government and local economy, banking, insurance, public finance, capital markets, treasury, market analysis and marketing, marketing management, entrepreneurship and innovation, small business, agrobusiness, estate economics, business communication,

[17]A more detailed consideration of the regional aspect of university education is presented in Chapter 2 of the report.

[18]Other higher schools do also offer many new specializations. And so, for instance, the curriculum of the Warsaw University of Technology for the academic year 1996/97 includes space and satellite technologies, as well as multimedia, and also a new direction of studies—administration. Within the University of Warsaw two new directions of licenciate-level studies were opened this year, namely Slavonic Languages and Initial Education with Re-Education, as well as two directions of complementary studies—Bookkeeping and Finance within the Faculty of Management, and Spatial Economy within the European Institute of Regional and Local Development.

etc. According to a very conservative assessment we can state that in the middle of 1980s the theoretical problems in the economics were the subject of work of some 17% of research scholars (with at least doctor's degree) employed in the schools of economics, and that 10 years later this share dropped to approximately 11%[19]. Furthermore, the scope of theory considered has also changed. Generally speaking, there has been a shift of orientation in the universities of economics towards the market-related problems, both in the scientific activity and in teaching of students. This was the expression of adaptation to the demand which appeared in the economic sphere and in social life (Bielecki, 1997).

* * *

When analysing the organizational changes, which took place in science and the universities we can conclude that these changes take, at least partly, the direction encouraging young people to work (e.g. due to appearance of the new attractive specializations) and counteracting the brain drain (e.g. through offering the possibility of additional remuneration for the conduct of lectures and exercises at the extramural studies). Side by side with this, though, the increasing teaching burden on the university employees may turn out to be a "push away" factor. On the other hand, the possibility of getting additional jobs at the non-public universities can neither be assessed unequivocally from the point of view of the outflow of the staff from the universities. Hence, altogether, the organizational changes taking place in the sphere of science cannot be interpreted in an unambiguous manner in the here considered context of the mobility of persons working in this sphere.

1.3. Characterization of the population of research scholars

There were almost 65.6 thousand research positions in Poland in 1996. The actual number of the research employees, though, is by several percentage points higher (in view of the occurrence of part-time work, though in some cases the same person was employed on more than one position). In comparison with the end of 1980s the number of positions, and of the persons employed, decreased somewhat, but during the last three years a slight increase was observed, mainly due to the increased employment in

[19]Estimate formulated on the basis of *Informator Nauki Polskiej 1985* and *1995/96* (*Directory of Polish Science* for the years *1985* and *1995/96*).

the universities, which employ now approximately 54.4 thousand persons. Lack of stability of the research staff is well visible within the institutes of the Polish Academy of Sciences. They employ currently about 3,900 persons, i.e. by 15% less than at the end of 1980s. These losses have been distributed relatively uniformly over the whole period of 1990s. A similar situation is observed in the research-and-development units, whose losses, as mentioned before, are, however, much greater—decrease of the research staff amounted to 40% of the employment from the end of 1980s, with important decreases in the consecutive years of the 1990s (see Table 1.6 and Fig. 6).

Table 1.6.

Research staff employment numbers and their dynamics* in Poland in the years 1988–1996 according to the types of employing units

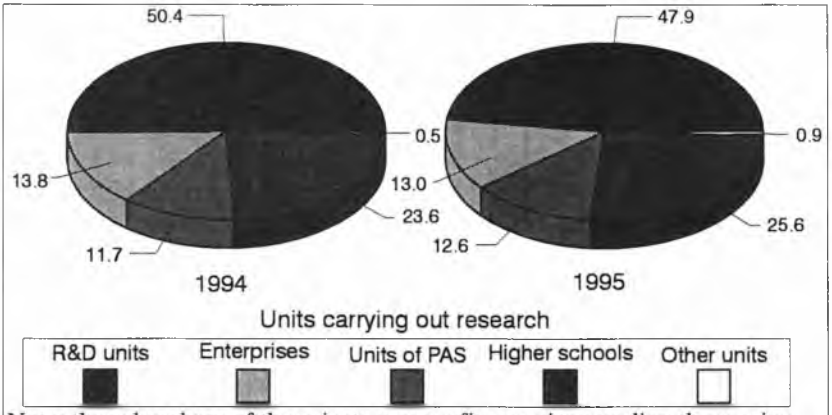
Unit types	1988	1989	1990	1991	1992	1993	1994	1995	1996
Institutes of the Polish Academy of Sciences:									
Numbers	4538	4587	4388	4385	4020	3972	3992	4064	3896
Previous year = 100	102.3	101.1	95.7	99.9	91.7	98.8	100.5	101.8	95.9
Research-and-development units:									
Numbers	21718	10912	10552	9314	8396	7820	7874	7927	7314
Previous year = 100	95.1	85.8	96.7	88.3	90.1	93.1	100.7	100.7	92.3
Universities**:									
Numbers	47742	50524	50048	51385	50688	50861	52106	52936	54364
Previous year = 100	.	105.8	99.1	102.3	98.6	100.3	102.4	101.6	102.7
Totals***:									
Numbers	65173	66183	65136	65201	63202	62713	63972	64927	65574
Previous year = 100	.	101.5	98.4	100.1	96.9	99.2	102.0	101.5	101.0

*Average values for a year; 1988–1990—persons employed full time; 1991–1996—persons employed full time and part-time expressed in full time equivalents.

**Persons employed in full time in more than one school are accounted for in each school separately.

***Jointly with the science support units, in which the numbers of research staff in the years 1990–1993 were, respectively: 148, 117, 98 and 60; for the subsequent years no data are available.

In the hierarchical structure of the research staff the junior researchers (assistant professors, assistant lecturers and research assistants) amounted in 1996 to 75.9%, while the independent staff members (professors and adjoint professors)—24.1% (see Fig. 7). In comparison with 1988 an essential worsening of this proportion took place (it was then equal 80.5:19.5). The share of the junior research staff decreased by 4.6 percentage points, and



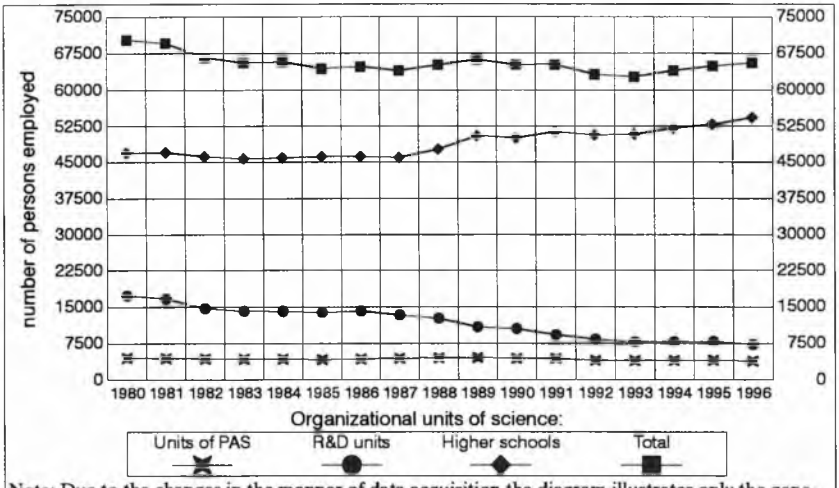
Note: the value share of the private non-profit organizatons directly carrying out the respective activities amounted to 0.003–0.02%.
Source: Own calculations on the basis of B. Rejn, Z. Żółkiewski, *Rachunek satelitarny nauki 1994-1995 (The satellite account for science in 1994–1995)*, „Z Prac Zakładu Badań Statystyczno-Ekonomicznych", issue 246, ZBSE GUS & PAN, Warszawa 1997, pp. 57 and 71.

Fig. 5. Expenditures on the R&D activity in Poland in the years 1994–1995 according to units carrying out the respective activities, in %

their number—by 6.6%, while the number of independent researchers increased by almost 23%.

Although during the last three years there has been a systematic increase of the numbers of junior staff (Table 1.7), which may indicate the turning of the decreasing tendency, but the level attained in 1996 is still below the one from the beginning of 1990s (see Table 1.8). The increments to the numbers of junior scientists are yet much slower than in the group of independent scholars, and so the process of worsening of the proportion considered has not been stopped. This amounts to stating that the intergenerational gap in Polish science is deepening.

The process of ageing of the scientific staff is most acute in the research-and-development units, where the number of the junior research employees decreased in the years 1988–1995 by 44%, and their share in total scientific employment declined by almost 9 percentage points. In the institutes belonging to the Academy of Sciences the decreases amounted, respectively, to more than 18% and approximately 7 percentage points. On the other hand, a possibility of an improvement appeared in the universities. Although the share of the junior scientists was in 1995 lower by



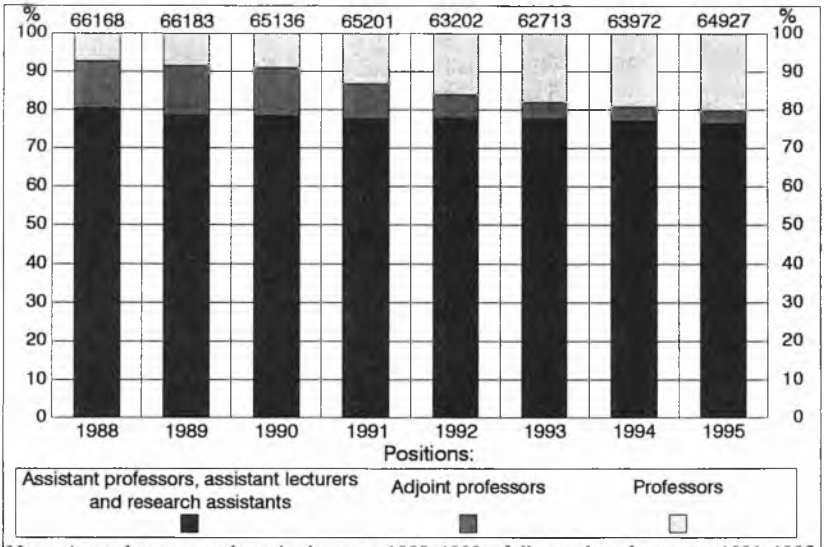
Note: Due to the changes in the manner of data acquisition the diagram illustrates only the general tendency.
Source: Statistical yearbooks published by GUS, various editions; *Mały rocznik statystyczny 1997 (Small statistical yearbook 1997)*, GUS, Warszawa 1997.

Fig. 6. Scientists in Poland in the years 1980–1996 according to types of units

2 percentage points than in 1988, but their absolute number increased in this period by 8% (see also Table 1.9).

The intergenerational gap is even more sharply illustrated by the number of the junior research staff per one independent scholar. While in the years 1988–1995 this number decreased altogether from 4.13 to 3.28, in the research-and-development units it decreased from 6.43 to 3.49, in the institutes of the Academy—from 2.91 to 2.10, and in the higher schools, where this decrease was the least—from 3.77 to 3.43 (Fig. 8).

The tendency towards the improvement of the situation at the universities is confirmed by the indicators calculated for some types of schools. The most visible progress occurred in the medical academies: from 4.86 to 6.10 of junior research staff per one senior scholar, which were followed by the naval schools—from 2.94 to 3.38, agricultural academies—from 3.11 to 3.53, and the higher schools of technology—from 3.98 to 4.28. An important worsening of proportions and deepening of the integenerational gap took place, on the other hand, in the higher schools of economics, where the indicator considered decreased from 3.43 to 2.05, and in the pedagogical schools, where it decreased from 4.43 to 3.16, and, to a much smaller degree, at the proper universities. This may constitute an indication of



Note: Annual average values; in the years 1988–1990—fully employed persons; 1991–1995—full time and part time employees in full time equivalents; persons employed full time in more than one higher school are accounted for in each of them.

Source: Statistical yearbooks of GUS, various editions; *Mały rocznik statystyczny 1997 (Small statistical yearbook 1997)*, GUS, Warszawa 1997, and own calculations.

Fig. 7. Structure of the population of research scholars in Poland in the years 1988–1995 according to positions taken

Table 1.7.

Scientific titles and degrees conferred in Poland in the years 1988–1996

Years	Professor titles*	Doctors of science	Totals		Doctors	
			Numbers	Previous year = 100	Numbers	Previous year = 100
1988	614	653	1267	.	2020	.
1989	910	755	1665	131.4	2440	120.8
1990	804	973	1777	106.7	2324	95.2
1991*	451	583	1044	58.8	1500	64.5
1992	568	1031	1599	153.2	1800	120.0
1993	447	912	1359	85.0	2000	111.1
1994	379	759	1138	83.7	2300	115.0
1995	367	628	995	87.4	2300	100.0
1996	543	784	1327	133.4	2400	104.3

* Until September 1990 two different professor titles were distinguished.

Table 1.8.

Structure of the population of the research employees in Poland in the years 1988–1996 according to positions occupied

Years	Professorships*		Adj. proffesorships		Assistant professors, assistant lecturers and research assistants	
	Numbers	% shares	Numbers	% shares	Numbers	% shares
1988	4,880	7.4	8,023	12.1	53,265	80.5
1989	5,649	8.5	8,597	13.0	51,937	78.5
1990	5,834	9.0	8,073	12.4	51,229	78.6
1991	8,632	13.2	5,927	9.1	50,642	77.7
1992	10,091	16.0	3,823	6.0	49,288	78.0
1993	11,305	18.0	2,720	4.3	48,688	77.6
1994	12,293	19.2	2,278	3.6	49,401	77.2
1995	13,049	20.1	2,131	3.3	49,747	76.6
1996	Professors + adj. professors				approx. 50,100	75.9
	Number		% share			
	15,831		24.1			

*Professorships include since 1991 persons not having the scientific title of professor, but employed on professor's positions. See also comments to previous tables.

Table 1.9.

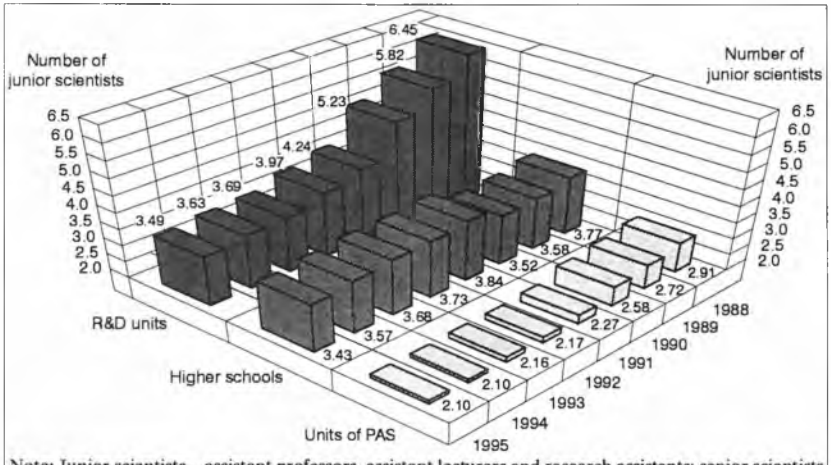
The structure of the population of academic teachers* at the universities in the years 1988/89–1995/96 according to positions occupied

Years	Professors		Adj. professors		Asst. professors		Assistant lecturers and res. assistants		Totals	
	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%
1988/89	3,867	8.0	6315	13.0	22,607	46.5	15,806	32.5	48,595	100.0
1989/90	4,261	8.6	6537	13.2	22,376	45.3	16,268	32.9	49,442	100.0
1990/91	5,597	10.9	5766	11.2	22,755	44.3	17,220	33.5	51,338	100.0
1991/92	7,569	14.8	3003	5.9	22,907	44.8	17,640	34.5	51,119	100.0
1992/93	8,914	17.4	1927	3.8	23,209	45.2	17,273	33.7	51,323	100.0
1993/94	10,155	19.4	1058	2.0	23,189	44.2	18,012	34.4	52,414	100.0
1994/95	10,945	20.3	826	1.5	23,587	43.8	18,476	34.3	53,834	100.0
1995/96	11,503	21.4	652	1.2	23,537	43.8	18,073	33.6	53,765	100.0

* Fully employed; teachers fully employed in more than one higher school are accounted for at each position occupied; excepting "senior lecturers" and "lecturers", teachers of specialized professional courses, foreign languages, sports, defense skills and auxiliary subjects, as well as professional disciplines, and practical execution of profession.

a weaker attraction to the occupation of a research scholar at a university of humanities and social sciences than at a medical or technical school.

The shortage of younger persons is also corroborated by the age structure of the staff employed in the whole R&D sphere (Korona, 1996). In

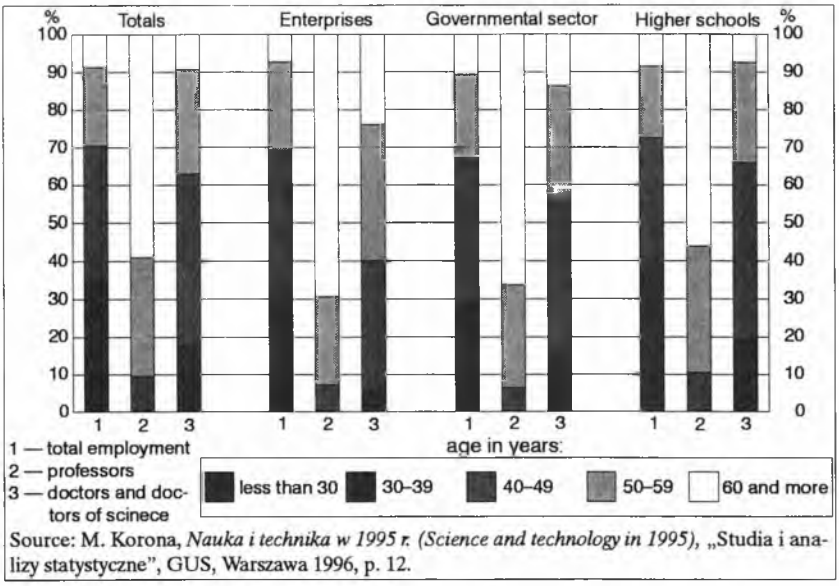


Note: Junior scientists—assistant professors, assistant lecturers and research assistants; senior scientists —adjoint professors and professors; data for higher schools refer to the academic years in the period 1988/1989–1995/1996.
Source: Own calculation on the basis of statistical yearbooks of GUS, various editions.

Fig. 8. Number of junior research scholars in Poland per 1 senior scientist in the years 1988–1995 according to the unit type

1995 the share of persons of less than 40 years of age was not quite 35%. There were, on the other hand, 8.5% of persons of 60 and more years of age. Professors (in terms of scientific title) of less than 40 years of age constituted the mere 9.4% of this group, while the majority of them (59%) were 60 and older. In the group of doctors of science and doctors the share of persons before 40 years of age was below 18%, while 45% of them were between 50 and 59 years of age. In terms of the age structure the situation is the worst in the units of the governmental sector, including the Academy of Sciences, where, on the average, the lowest share of persons below 40 work (approximately 30%) and the greatest share of those above 60 years of age (10.5%). Situation is the best with this respect within the university sector, where the respective shares amount to 39% and 8.3%. Here also the share of professors of less than 40 years of age is the highest (more than 10%), like it is, as well, for the doctors of science and doctors in the same age group (approximately 66%), see Table 1.10 and Fig. 9.

There is a phenomenon observed on an increasing scale among the research employees consisting, as mentioned before, in working in two or more establishments, and especially the simultaneous employment in the state and private institutions, or employment in the scientific and non-scientific institutions (e.g. the state administration). This concerns,



Source: M. Korona, *Nauka i technika w 1995 r. (Science and technology in 1995)*, „Studia i analizy statystyczne", GUS, Warszawa 1996, p. 12.

Fig. 9. Structure of employment in R&D activity in Poland in 1995 according to sectors, scientific degrees and titles, and age

in particular, the employees of the universities and the Polish Academy of Sciences. The possibilities of having a second job seem to be distinctly smaller, on the other hand, for the persons working in the research-and-development units, due to a different character of work from that in the Academy or at the universities. The state establishments provide usually the basic jobs, i.e. those which secure the adequate prestige and the guarantee of the appropriately high rank for the other employer. It is increasingly frequent, though, that the basic job in the state-run entity is replaced by the job in a private one, whose very existence depends upon the basic employment of the formally required minimum number of professors. The factor which has a decisive influence upon the making of such decisions is the much higher level of salaries offered in the private sector. Financial motivations make also the research employees with lower titles and degrees look for basic jobs in the private sector. Similarly, there is an increasing frequency of leaving the state research establishments and taking up jobs in the private schools and other private units, though this phenomenon has not, as yet, grown to any considerable dimensions.

In this context it is worth considering what is the share of part-time university teachers in various types of schools. The part-time employment

concerned in Poland in 1995 altogether 5.7% of academic teachers, this share amounting to 4.8% in the state-run higher schools and to more than 25% in the non-public ones[20]. It can be supposed that in the majority of the latter cases the basic employment is with the state-run schools. This phenomenon is especially pronounced among the assistant professors in private schools—20% of the thus employed persons are part-time employees. In the state schools this concerns only 2.4% of the group in question. The same phenomenon affects to a much lower degree professors (7.6% in the state schools and 14.5% in the private ones). The part-tme employment is, on the other hand, a common phenomenon among the proper teaching staff working in the non-public schools. Almost 40% of these persons are part-timers. In the state-run higher schools this share is about 10%. We can cite here as the extremum instance the case of pedagogical schools, where almost 57% of the academic teachers are part-time employees. They are followed by the technical schools with the respective share amounting to 48%.

The phenomenon of double employment is the source of mixed feelings in the scientific community. In general, though, a tolerant attitude prevails, resulting from the awareness of incapacity of changing this situation and of a significant improvement in the financial position of the research scholars, attained owing to this double employment. Although arguments against are also cited, like lack of time for research, for advancement of own knowledge, for reading of the current scientific literature, or lowering of the teaching quality, but these arguments fade away in comparison with the positive ones (Barlik, Demczuk, 1997).

The greatest concentration of the persons employed in the research and development sphere occurs in Warsaw, followed by Cracow, Wrocław and Katowice. In Warsaw province in 1995 this sphere of activity employed more than 37.6 thousand persons, i.e. almost ⅓ of all in the country. In Cracow province 12.6 thousand persons were employed, i.e. 10.7%, in Wrocław province—8.8 thousand (7.5%), and in Katowice province—9.3 thousand (7.9%). Somewhat smaller centers were constituted by such provinces as Łódź (7.1 thousand and 6.0%), Poznań (6.5 thousand and 5.6%), Lublin (6.5 thousand and 5.5%), and Gdańsk (5.8 thousand and 4.9%), see Korona (1995, pp. 41–43). The degree of spatial concentration is yet bigger in the group of persons with scientific degrees and titles. Thus, in 1995 there were in Warsaw province almost 38% of all professors in Poland and 28% of all doctors and doc-

[20] *Szkoły wyższe w roku szkolnym 1995/96 (Higher schools in the academic year 1995/96)*, op. cit., pp. 74ff.

Table 1.10.

Employment structure in the R&D activity in 1995 according to sectors, scientific titles and degrees, and age, in %

Employee groups	All sectors	Enterprise sector	Governmental sector	University sector
Totals	100.0	100.0	100.0	100.0
29 years of age and less	11.6	9.5	9.1	13.7
30–39 years	23.2	21.0	21.0	25.3
40–49 years	35.7	38.7	37.1	33.6
50–59 years	21.0	23.5	22.4	19.2
60 and more years of age	8.5	7.3	10.5	8.3
Persons with professor's title	100.0	100.0	100.0	100.0
29 years of age and less	0.0	0.0	0.0	0.0
30–39 years	0.5	0.3	0.2	0.6
40–49 years	8.9	6.9	6.3	9.8
50–59 years	31.8	23.6	27.4	33.6
60 and more years of age	58.9	69.3	66.2	56.1
Doctors of science and doctors	100.0	100.0	100.0	100.0
29 years of age and less	0.6	0.2	0.5	0.6
30–39 years	17.4	6.1	15.6	18.7
40–49 years	45.0	33.9	40.9	46.7
50–59 years	27.7	36.0	29.6	26.7
60 and more years of age	9.3	23.9	13.4	7.3

Data as of December 31st.

Source: M. Korona, *Nauka i technika w 1995 r. (Science and technology in 1995)*, "Studia i analizy statystyczne", GUS, Warszawa 1996, p. 12.

tors of science. The respective shares of Cracow province were 13% and 12%, of Wrocław—9% and 11%, and of Lublin—7% each (Chojnicki, Czyż, 1996).

The concentrations mentioned are connected, in particular, with the location of the greatest academic centers in these provinces. The number of academic teachers in Warsaw was in 1995 at 10.8 thousand, in Cracow—8.5 thousand, in Wrocław—6.2 thousand, in Poznań—6.1 thousand, in Upper Silesia—5.2 thousand, in Łódź—4.8 thousand, in Lublin—4.3 thousand, and in Gdańsk agglomeration—4.0 thousand. In comparison with 1989 there has been in all the centers, excepting Wrocław, a slight increase of the numbers of academic teachers, with the relatively bigger increases taking place in smaller centers. In this context let us remind that, as mentioned previously, entirely new centers appeared on the map of Poland, featuring a stable research and teaching staff. Attention should in particular be paid to such new centers as Nowy Sącz, where 81 persons

were fully employed in 1995, Pułtusk with 77 fully employed, Bielsko-Biała—63 persons, or Płock—42 persons. This means that the development of the higher schools and scientific institutions in smaller centers may constitute a factor of attraction to work in the sphere here considered.

1.4. Financial standing of the scientific institutions and their staff

The decreasing outlays into science and the universities in 1990s caused the worsening of the financial situation of many respective institutions. A characteristic feature, observed already at the beginning of 1990s, was the increase of differentiation among individual institutions, and therefore also among particular groups of persons employed on similar positions. This was the effect of both the progressing differentiation of wages and of the personal deftness of the managers and the employees themselves in acquiring the financial means from the outside, also from the foreign sources. Not all of the institutions, subject to market mechanisms, were capable of managing to a similar degree. Thus, the sciences in which fundamental research plays an important role turned out to be handicapped by the new situation, since it is much more difficult—if not just impossible—to obtain the external (non-budgetary) means for such research, while applied sciences may count on this kind of input. The applied sciences had namely encountered an important demand for expert assessments, detailed studies, analyses, opinions, concepts, programmes etc., generated by numerous institutions of socio-economic life. Consequently, in the more "smartly" operating institutions the compensations of the employees include, side by side with the formal wages, also additional revenues from the research programs. Liekwise, these teaching units fare better which conduct relatively many activities within the framework of the paid extramural studies. Their employees can expect definite profits accruing from such activities. Under such circumstances the true assessment of the financial situation of the institutions and their employees is quite difficult[21].

[21]The difficulties are yet amplified by the fact that the official statistics do not confirm the higher earnings neither in the private units conducting research-and-development work, nor in the non-public higher schools. And so, for instance, in 1995 the monthly wages in the private establishments were lower by 2 to 5% than in the public ones. See *Koszty pracy w usługach społecznych i pośrednictwie finansowym w 1995 r. (Labour costs in social service and financial intermediation in 1995)*, "Informacje i opracowania statystyczne", GUS, Warszawa 1996.

In case of certain units from the sphere of science one can refer to an indirect method of analysis—the traditionally used indicator of the degree of wear of the research equipment, reflecting in a way the financial capacities of the given institution. It can namely be expected that this degree is lower in the richer institutions, which can afford replacement of the worn out equipment. A closer look at this indicator in various units all over the country reveals, though, the fact that the general condition of their equipment is indeed very bad. Thus, in 1995 the degree of wear of the research equipment in all institutions excepting higher schools exceeded 73%. The situation was definitely at its worst in the institutes of the Academy of Sciences, where the indicator value was almost 84%, and then in the "central laboratories"—78% (see Table 1.11). After a temporary improvement in terms of this indicator in the years 1993–1994 it grew again in 1995.

Table 1.11.

Degree of wear of the research equipment in the scientific and research-and-development establishments in the years 1990–1995, in %

Institutions	1990	1991	1992	1993	1994	1995
Total—average	66.5	75.7	80.3	74.4	65.5	73.2
Institutes of the Academy	76.0	79.0	92.4	85.3	82.1	83.6
Research-and-development units, with breakdown into:	60.4	74.7	76.5	70.7	60.1	69.7
—research institutes	61.9	75.7	76.1	70.5	61.7	70.1
—central laboratories	63.5	89.2	68.9	73.8	73.6	77.6
—research-and-development centers	51.0	67.6	78.0	69.3	46.2	69.7

Against the background of such data a doubt of a more general nature arises, related to the "sense" of functioning of the institutions equipped with so worn out facilities, which therefore require frequent repairs. Is it possible to conduct advanced research with such equipment? Whatever the answer, the very existence of the problem certainly does not constitute an element that would attract new employees to science.

Concerning the average monthly earnings, research scholars usually earn more (excepting the most junior ones) than the national average. The salaries of professors amounted in 1995 to the double of the national average. After a certain worsening of this relation for all the categories of positions had taken place, its level came in 1995 close to that of 1990 (see Table 1.12). It is, of course, not quite without any doubt whether the comparison with the national average is justified, since we are dealing to a large extent with persons of the highest skills. Such comparisons are,

however, applied in the respective analyses and it seems that in spite of their partial inadequacy they ought not to be given up.

The average wages of the junior research scholars (including assistant professors) changed to the disadvantage in relation to the earnings of the independent scholars. While in 1989 the junior research scholars earned on the average 61% of the earnings of the senior scholars, in 1995 this ratio decreased to 57%. The assessment of the increasing differentiation between the two employee categories considered can be made from two points of view. On the one hand, the distance which separates the earnings of these two groups ought to be adequately big, since they differ importantly as to their level of knowledge, skill and experience. This difference would also embed the mechanism of motivation for the advancement of knowledge and skill and constitute the driving force of progress. On the other hand, the absolutely low level of salaries of the junior scientists are not an attraction factor for taking up work in science, and rather conversely, when they get even lower in comparison with other professional groups, they become a destructive factor and lead to giving up of employment in research and teaching. The action of the second mechanism mentioned would, however, be much weaker, if the absolute level of salaries were appropriately higher.

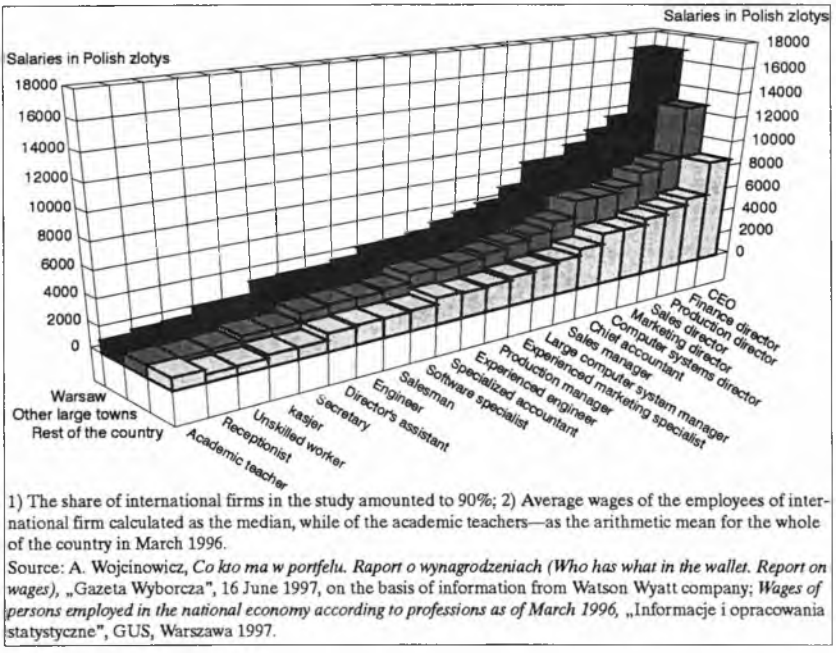
Table 1.12.

Average monthly wages* of the research scholars in the years 1990–1995 according to the positions taken

Positions	1990	1991	1992	1993	1994	1995
A. in relation to average monthly pay in the national economy (=100)						
Averages	130.3	123.1	125.7	125.6	122.4	130.2
Professors	209.9	187.8	190.3	195.3	191.8	200.7
Adj. professors	171.5	167.6	172.2	185.0	181.5	185.1
Asst. professors, asst. lecturers and research assistants	114.0	108.3	109.1	111.3	107.6	109.3
B. in USD, according to the mean exchange rate value						
Averages	.	204.2	267.6	270.2	282.7	370.9
Professors	.	311.6	404.6	420.2	443.2	572.0
Adj. professors	.	278.2	366.0	398.2	419.3	527.6
Asst. professors, asst. lecturers and research assistants	.	179.7	231.9	239.4	248.5	311.5

*Until 1991 the data concern the net categories.

Interesting conclusions can also be drawn from the analysis of earnings of the research employees expressed in terms of convertible currencies (this expression being justified by the level of prices in Poland which in



1) The share of international firms in the study amounted to 90%; 2) Average wages of the employees of international firm calculated as the median, while of the academic teachers—as the arithmetic mean for the whole of the country in March 1996.

Source: A. Wojcinowicz, *Co kto ma w portfelu. Raport o wynagrodzeniach (Who has what in the wallet. Report on wages)*, „Gazeta Wyborcza", 16 June 1997, on the basis of information from Watson Wyatt company; *Wages of persons employed in the national economy according to professions as of March 1996*, „Informacje i opracowania statystyczne", GUS, Warszawa 1997.

Fig. 10. Average monthly gross salaries of academic teachers against the background of the salaries of persons employed in international firms in Poland in 1996/97 according to positions and location of the firms

many cases is comparable to that in the western countries). According to the mean exchange rate of the National Bank of Poland (the central bank for Poland) a research employee earned in 1995 on the average 371 USD, and a professor—522 USD, while an average junior scientist—312 USD. Although there has been an essential progress in particular groups since the beginning of 1990s, ranging from 73% of increase in the junior group to 106% for the adjoint professors (see also Table 1.12), but still, in relation to the western universities and research establishments Polish scientists remain in the position of "poor cousins", which turns out to be especially hard in direct contacts. This situation is, however, yet harder in the contacts with the employees of many private firms, especially foreign ones, located in the country. And so, for instance, a CEO of a foreign firm in Warsaw earned in 1996 more than 4400 USD per month, an accountant auditor—3650–4380 USD, a chief accountant—2500–3300 USD, an administrative logistics manager—2200 USD, a salesman—1300 USD, a secretary-assistant to

director—900 USD, and a secretary-receptionst—450–750 USD[22]. These wage levels do not account, of course, for the fringe benefits, such as service car, additional insurance or bonuses for good results in work. The reference to the example of the foreign firms is by no means just a formal trick serving to show the differences in wages. It must be remembered that these firms are an important competitior on the labour market with respect to the best of the graduates. The outputs from many a survey show that the foreign companies are the most desired job offerers[23].

It must be remembered that earnings obtained on similar positions differ depending upon the magnitude of the firm and its financial situation, and location in the country. The sums obtained in Warsaw are definitely higher than in other large towns, and even more so in comparison with the rest of the country. The persons working in the international firms in the large towns outside Warsaw earn approximately 70–80% of that what those in Warsaw do, while in relation to other centers this proportion drops to some 50%[24]. Although in the case of research scholars the wage levels are similar in all centers, but Warsaw offers much greater possibilities of additional work than any other place does. Still, it is highly symptomatic that these wages are approximately at the level of the earnings of blue collar workers—those who earn the least in the respective firms—or even lower than that (see Fig. 10). This is contrary to the quite significant social support given the idea that the better educated persons should earn more. Although some 15% of persons questioned in 1994 thought that there should not be such a correlation, but, on the other hand, more than 70% maintained that "yes" ("always" and "with exceptions"), the better educated ought to be paid better[25].

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[22]*Jak nas widzą (How do they see us),* "Gazeta Wyborcza", 21 July 1997, on the basis of information from SMG/KRC company.

[23]See *W finansach za 1160 zł. Oczekiwania studentów SGH (In the finance for 1160 Polish zlotys. Expectations of the students of Main Trade School),* "Gazeta Wyborcza", 9 May 1995; and *Żak tutaj, obok i dalej (A student here, aside and farther),* "Gazeta Wyborcza", 10 March 1997.

[24]The differences of salaries between Warsaw and other centers concern many institutions. Thus, for instance, the average monthly gross salary in the self-governmental administration in Poland was in 1996 at some 970 PLN, while in the Office of the capital town of Warsaw—at approximately 1700 PLN. See *Zatrudnienie i wynagrodzenia w administracji publicznej i pośrednictwie finansowym w 1996 r. (Employment and wages in public administration and financial intermediation in 1996),* "Informacje i opracowania statystyczne", GUS, Warszawa 1997.

[25]*Potrzeby edukacyjne (Educational needs),* op. cit., p. 56.

2. THE ROLE OF UNIVERSITY IN REGIONAL DEVELOPMENT

2.1. Introduction

The City, the University and the Region were always mutually linked. Universities were established in towns and each significant medieval urban centre would attempt to host one. On the other hand, the university, by attracting scholars and students, would become a factor in urban growth. There were periods in the history of towns when the teachers and students constituted a very important share of urban population. And so, in the middle of 18th century in Cracow there were among 10,000 inhabitants some 2,000 students. Within certain areas of Italy, France and southern Germany a network of universities appeared quite quickly, playing a pronounced role in urbanization of the respective areas and in the regional development [1].

The network of universities and other higher education establishments is decisive for the intellectual potential of the region, for the qualities of the persons employed in industrial enterprises and in other domains of economic and social life. The institutes and laboratories of universities produce knowledge and develop new technologies. Universities create also advantageous cultural climate, being one of the factors of regional development.

A university is one of the most important assets of a region. Frequently, presence of a higher educational institution is one of the factors deciding of the location of an enterprise, since such an enterprise acquires thereby the possibility of having its activity scientifically supported and of ensuring adequate education for the children of the employees.

2.2. Functions of university education

It is usually assumed in the literature of the subject that university education should fulfill four fundamental functions, though the mutual

[1] This chapter contains the fragments of a bigger report produced at the UNESCO Chair of Sustainable Development, entitled *The Role of University in Regional Development. The case of Poland and Slovakia.*

proportions of these functions may differ depending upon the type of a school. These four functions are as follows:

- education as such,
- scientific research,
- support for the technological advance,
- formation of a cultural climate.

There are opinions, voiced since some time already, that the main task of the university is to teach[2]. This view is based upon the observation of numerous cases in which research, especially in the universities, pushes back the function of teaching. This is so because the majority of persons employed at the universities prefer to develop their selves through research rather than through teaching, and, moreover, many higher schools and their employees obtain, due to research, additional financial means. On the other hand, though, limitation of the function of the university to just education would lower its level of teaching insofar as the lecturers would not be able to progress in their respective domains and to transmit to their students the knowledge acquired due to their own inquiry. In the extreme form this second view reduces to the proposition that the mission of the university is first of all to make science advance.

Universities do in practice quite harmoniously link the functions of creation of knowledge and teaching, with other types of higher (post-secondary) schools concentrating primarily on teaching, and science being also developed in the specialized research institutes, forming structures which are more or less separate from the higher education system, like CNRS in France, the Max Planck Institute in Germany, or the Academy of Sciences in Poland.

The broadest scope of functions is, of course, fulfilled by the proper universities, which transmit virtually the whole spectrum of knowledge. The classical university was composed of four faculties: medicine, law, theology and liberated sciences, in order then, along with the development of the new disciplines, to become a place hosting a dozen faculties. The modern model of the university takes various shapes in different countries. Starting with the end of 1940s the medical faculties were separated in Poland from the rest of the university, and transformed into self-standing higher schools. There was a similar move, of political background, with respect to theology. Universities in Poland teach—like in other countries,

[2] J. H. Newman, *Idea uniwersytetu* (*The Idea of University;* Polish translation), quoted after E. Wnuk-Lipińska, *Innowacyjność a konserwatyzm, uczelnie polskie w procesie przemian społecznych* (*Innovativeness and conservatism, Polish universities in the process of social transformations;* in Polish), Warszawa 1996, pp. 16–17.

anyway—the greatest number of students among all the types of higher schools. Side by side with the proper universities there exist in Poland the universities of technology, which have evolved since a dozen years from the schools of relatively narrow technical profile towards the full fledged universities teaching also humanities, economics and social sciences[3].

While the postulate of enhancement of the accessibility of university education and of its actual reach appears to be beyond doubt, discussion concentrates on the question of differentiation of the levels of teaching in various types of higher schools. On the one hand, namely, care should be taken of the possibly democratic character of university education and its egalitarian nature, but, on the other hand, one cannot forget of the necessity of educating a well selected elite capable of facing the toughest challenges. In the practice of some countries this delicate balance between egalitarianism and elitism is being maintained in such a way that side by side with the relatively easily accessible higher schools there are other ones, which do select their candidates in a very sharp manner. And so, for instance, in the USA, along with the average universities there are the ones classified in the so called *"Ivy League"*, while in France there is the system of *"Grandes écoles"*—Ecole Polytechnique, Ecole Nationale d'Administration etc., and in United Kingdom—the universities of Oxford and Cambridge.

The requirements of the modern technological and regional development pose new problems to be solved by the universities and other higher schools. Modern development of industrial production is increasingly connected with application of new technologies, which are being developed in a close connection with the scientific laboratories located in the universities, so that some schools have within their organizational structures the technological centers oriented at development and implementation of innovations.

Higher schools become in an increasing degree the centers supporting regional development because they do not only support the development of technology, but also offer a broad spectrum of education directions, including permanent education, both for the inhabitants of the region and for the children of the potential local employees, who can therefore be attracted by the established "scientific climate", and settle in such a region.

Higher schools of a rank that is lower than that of the proper universities, but which form an appropriate network in space, may also become

[3]In a somewhat arbitrary manner the technical higher schools in Cracow, Gdańsk, Gliwice, Łódź, Poznań, Warsaw and Wrocław were classified as universities of technology. The remaining ones should rather be treated as higher professional schools.

a factor of regional development, due to facilitation of conditions for study in smaller centers. Regional network of higher schools lowers the social costs of education and thereby enhances the democratic character of this education.

Social function of a university shifts along with the course of economic and social transformations. Until now one of the main growth factors was constituted by material resources, while nowadays it is the knowledge basis which becomes the most important growth factor, being the source for the constant flow of innovations. That is why the measure of development of the societies, previously equated with the economic development level, is currently associated with the development of science, which can also be the basis for the typology of social development, with the societies existing until now being classified into *pre-scientific, proto-scientific* and *scientific.*

Thus, in the *pre-scientific* society there exist various forms of scientific cognition, but science functions entirely independently of the economy and social life, is in fact more a ludic activity than a pragmatic one, while the methods of transmitting knowledge are little institutionalized. Science develops in quite a spontaneous manner, and society treats scientists as more or less dangerous maniacs.

In the *proto-scientific* societies there exists already an institutional manner of transmitting knowledge, and the most important structure therein is constituted by the university. Research is still being conducted in separation from economy and technology, though the inventions and scientific discoveries appearing are more and more often applied in practice. Technique and technology develop, however, rather through imitation than due to systematic scientific study. There is direct feedback between science and economy. Society treats scholars as a group of people who are in principle harmless, sometimes useful, but altogether unproductive. Science develops still primarily spontaneously.

In *scientific* societies science is strongly institutionalized in the form of specialized research organizations, working more or less directly for the satisfaction of needs arising in technique, technology, management and sociotechnique. A lone scientist resolving problems of science in the calm of his/her laboratory is replaced by the teams of researchers, working under the leadership of animators who are both intellectual pathfinders and managers effectively organizing the course of study. Universities transform from a loose academic community into effectively managed, productive organizations for education of highly skilled staff.

Both enterprises and the governmental institutions (primarily the military) plan, stimulate, inspire and finance scientific research, so that its

development has to a large extent a directed character. The development of technique and technology takes place almost exclusively owing to scientific discoveries, and science itself becomes one of the main economic growth factors. Society treats scientists as a highly productive category of employees.

The spatial reach, and therefore also the respective reference domain, of the higher schools, and especially of the universities, depends upon their rank. Each school is located in a definite place, and has local significance, sometimes so big that it is decisive for the character of the locality, vesting it with an irreproducible climate. Such universities and their home locations like Cambridge, Oxford or Princeton are the examples here. When a town is too big, a university can endow with a specific climate one of its quarters. This is the case of the Old City in Cracow or of Quartier Latin in Paris. On the other hand, a not too successful spatial form is constituted by the university campuses located within the urban peripheries, separated from the town itself and forming a kind of ghetto.

A university, though, has side by side with the direct local reference area also regional significance. By admitting students from a greater spatial domain it becomes a magnet attracting the most gifted individuals and is the model-creating place for the regional society. The best of higher schools usually have country-wide reference reach, since they offer the highest level of education and, due to their opinion, the best opportunities for the professional career. Another factor, which increases the spatial reach of a school, may be constituted by the unique directions of teaching in very specialized domains of knowledge. There are, of course, some schools of continental, or even global, reach, and they attract not only students from many countries, but also the most famous scientists.

2.3. Regional setting of higher education in Poland

The system of university education, functioning in Poland, had had until quite recently an egalitarian and uniform character. Both the universities and the higher schools of a narrower profile applied similar mechanisms of selection and criteria of admission of the graduates of the secondary schools, taking altogether the form of similarly conducted entry examinations. The system was also largely uniform. Studies would last five years at [virtually] all universities, and the graduates would obtain the master's title. It is only since quite a short time that in the private higher schools studies last three years and the graduates leave the school as licentiates.

Some universities, and also research institutes, conduct doctoral studies, which constitute a preparation for the research work.

Thus, all the state universities, irrespective of their profile and level, issue identical diplomas, and their employees belonging to particular groups, defined by the degree and scientific title, obtain identical compensation.

In spite of the formal uniformity of the universities, their actual levels are quite differentiated. There is no formal ranking of the schools, though it functions in the consciousness of the high school graduates and their parents, influencing the decisions on the location in which further learning ought to take place. Since a couple of years an informal ranking of universities is being conducted and published by one of the most popular Polish weeklies.

Higher schools cluster in Poland in the greatest urban centers, with the degree of concentration of schools, students and the employees being quite important. And so, Warsaw hosts 40 higher schools, 12 state-owned and 28 private ones, with approximately 110,000 students and abount 10,000 academic teachers. The second greatest center of university education is Cracow, followed by the Upper Silesian agglomeration and Poznań (see Table 2.1). These four centers of higher education of the Ist order group together 80 higher schools in which 42% of all students learn and 45% of all academic teachers are employed (Table 2.2). The subsequent five towns, which are the centers of university education of the IInd order, concentrate 42 schools, at which 28% of all students are taught, and approximately 33% of all the academic teachers are employed.

Table 2.1.

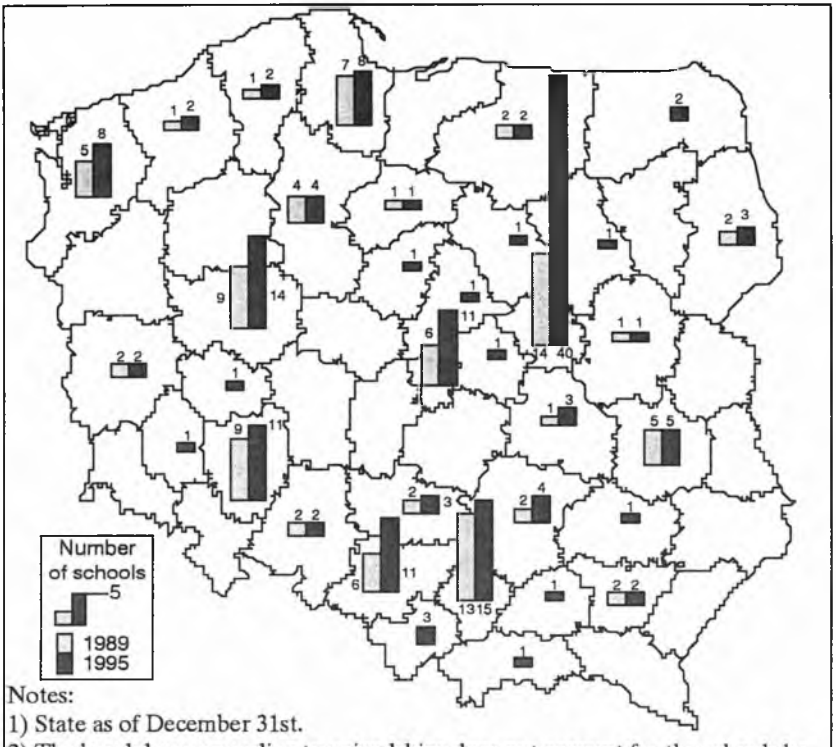
Centers of university education of particular order in 1995

Center order	Number of towns	Number of schools	Students		Academic teachers	
			in '000	in %	in '000	in %
I	4	80 (2)	325.2	41.6	29.4	45.0
II	5	42 (4)	215.1	27.6	21.6	33.1
III	10	26 (7)	174.6	22.4	11.6	17.8
IV	8	8 (4)	42.6	5.5	1.7	2.6
V	8	5(11)	16.6	2.1	0.8	1.2
VI	17	8(11)	6.3	0.8	0.2	0.3
Totals	52	169(39)	780.4	100.0	65.3	100.0

Notes: 1) The table does not account for the military nor police establishments; 2) The figures in brackets denote branches and regional departments.

As can be seen from these data, in spite of a certain dispersion of schools the concentration of higher education in Poland is significant and it practically clusters into the nine largest regional centers. In southern Poland we

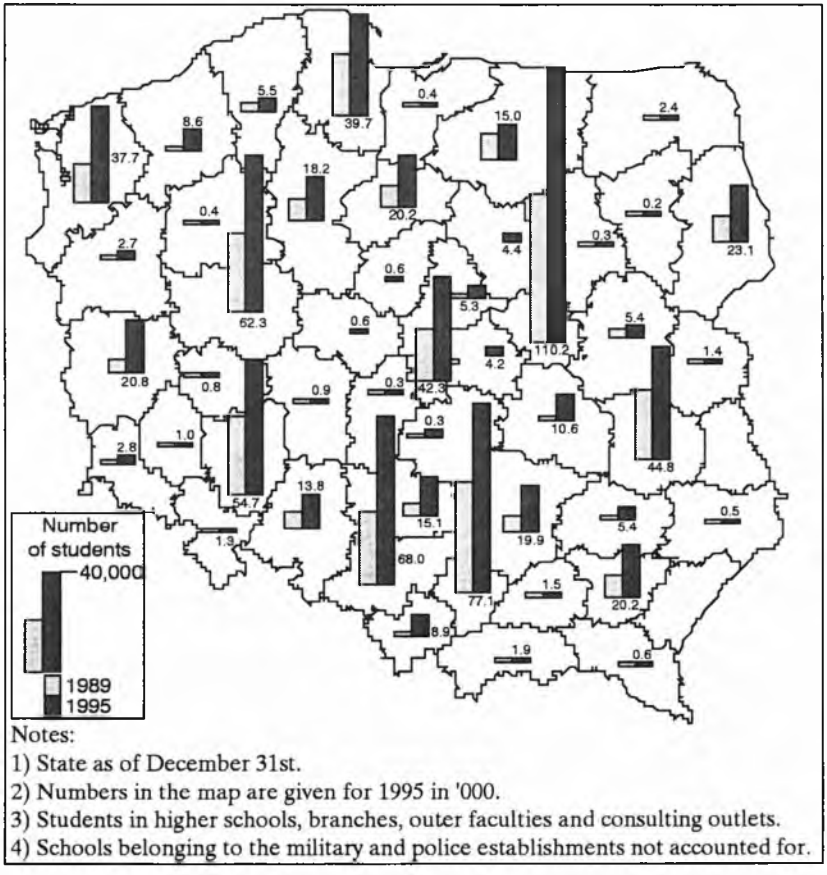
have three large centers of university education: Wrocław, Katowice (Upper Silesian agglomeration) and Cracow. In the middle latitudinal belt of the country four centers function: Poznań, Łódź, Warsaw and Lublin, while in the northern parts of Poland there are only two such centers: Szczecin and Gdańsk. These nine centers of higher education are complemented by the network of schools located in smaller towns. From the point of view of geographical location higher schools are most sparsely distributed over eastern Poland, where side by side with Lublin, classified as a IInd order center, there are only two IIIrd order centers: Białystok and Rzeszów.



Notes:
1) State as of December 31st.
2) The breakdown according to voivodships does not account for the schools belonging to the Ministries of Defence and Home Affairs, altogether 15 of them in 1989 and 10 in 1995.
3) Total number of higher schools was 112 in 1989 and 179 in 1995. Besides this there existed 30 branches and outer faculties of higher schools in 1989 and 39 in 1995.

Fig. 11. Numbers of higher schools in the years 1989 and 1995 according to voivodships

In some cases higher education plays a very important role in the economic and social structure of a town. If we just consider the academic centers of the first three orders and the towns of more than 100,000 inhabitants then we conclude that universities have the greatest importance in such towns as Zielona Góra (176 students/1,000 inhabitants), then in Rzeszów (126 students/1,000 inhabitants), Lublin (125), Poznań (112), Cracow (107) and Opole (106).



Notes:
1) State as of December 31st.
2) Numbers in the map are given for 1995 in '000.
3) Students in higher schools, branches, outer faculties and consulting outlets.
4) Schools belonging to the military and police establishments not accounted for.

Fig. 12. Nmbers of students in the years 1989 and 1995 according to voivodships

The number of academic teachers—given the general decreasing tendency —is strongly regionally differentiated with respect to their ratio to

the number of students. The average number of students per 1 academic teacher was in 1995 in Poland at 12.0, as compared to 8.0 in 1980. This indicator, although having worsened, is close to the European averages. The best values of the indicator in the centers of Ist and IInd order (below 10) are noted in Łódź, Wrocław and Cracow, while the worse ones—the highest—in Szczecin and in Katowice agglomeration. The situation is clearly yet worse in provincial areas in the IIIrd order centers, where in some towns the indicator value attains 20, and in Zielona Góra approaches even 25. Still, the truly worst cases are related to private schools functioning in small provincial centers, where shortage of adequate teaching staff makes doubtful the attainment of any satisfactory level of education. And so, for instance, in Suwałki there is one academic teacher per 120 students. Lower, but still very high values of the indicator are observed in quite large schools (of more than 4,000 students) in Łowicz (82) and in Pułtusk (58).

Thus, altogether nine centers group 122 schools, which teach more than 70% students and employ almost 80% of all the academic teachers. In the remaining 43 localities there function 47 self-standing schools and 33 branches of higher schools having their seats in bigger centers.

Private schools which started to emerge after 1990 imitate in principle the previously existing system of the state-run university education. In the centers of the Ist order 44 private higher schools function, i.e. 55% of them, with further 12 being located in the centers of the IInd order. One should note, though, that several private schools were established, in a way, "from scratch" in medium and small towns, where no higher schools had existed before. Among the entirely new centers of higher education, which have already gained good fame, let us mention Łowicz, Nowy Sącz or Pułtusk (Table 2.3).

Growth of the private higher school sector is one of the characteristic phenomena of the period of political, economic and social transformation, which started in Poland in 1989. These schools fill primarily two gaps. First, by increasing supply in the domain of education they enable better satisfaction of demand, and, besides, by educating first of all the economists, they meet the demand for this kind of specialists, necessary for the functioning of market economy. To a lesser degree, though, they complement the regional systems of higher education, though, as already mentioned, they are also being established in these localities where no universities had existed before.

One of the features of the Polish system of university education is constituted by the branches of universities operating usually in smaller centers. The greatest number of branches (12) is being operated by the university

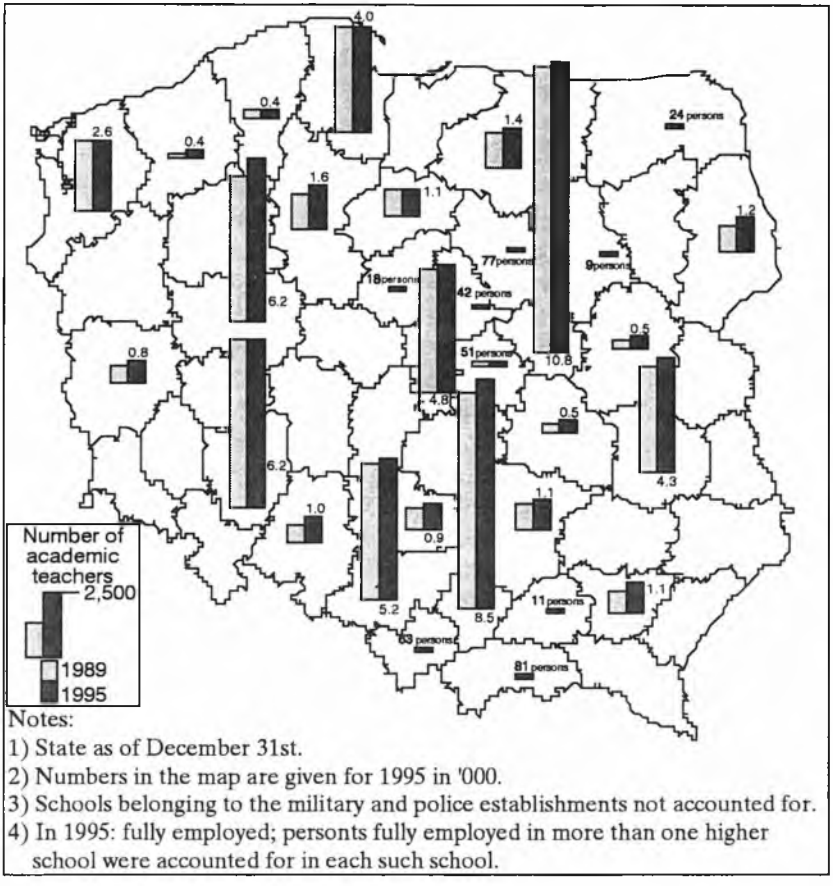


Fig. 13. Numbers of academic teachers in the years 1989 and 1995 according to vivodships

type schools from Warsaw, followed by those from Lublin, Wrocław, Cracow and Poznań, i.e. the schools functioning in the centers of the Ist and IInd order (see Table 2.4).

The reach of influence of the centers of the Ist and IInd order is fairly wide and usually encompasses several units of the administrative division of the country (voivodships or provinces). This area of influence spans sometimes—like in the case of Wrocław—the area of the former larger voivodship[4]. And, so, for instance, the Technical University of Wrocław has

[4]In 1975 Poland underwent a change of the territorial division of the country. In place of the former 17 larger administrative units 49 small ones were established.

Table 2.2.

Spatial distribution of higher schools in Poland in 1995

Localities	Rank	Population in '000	Students per 1000 inhabitants	Number of schools	Students	Number of academic teachers	Ratio of students to teachers
POLAND	x	x	x	169(39)	780376	65299	12.0
Ist order							
Warsaw	1	1635	69	40	112303	10054	11.2
Cracow	2	745	107	15	80044	8357	9.6
Katowice (agglo.)	3	2118	32	11(2)	67646	5094	13.3
Poznań	4	581	112	14	65148	5936	11.0
IInd order							
Wrocław	5	643	92	11(1)	54244	6097	8.9
Lublin	6	355	125	5(1)	44223	4236	10.4
Łódź	7	823	50	10	41185	4607	8.9
Gdańsk. Gdynia	8	758	51	8	38876	4008	9.7
Szczecin	9	418	87	8(2)	36524	2612	14.0
IIIrd order							
Białystok	10	279	82	3(3)	23008	1956	11.8
Zielona Góra	11	116	176	2	20400	822	24.8
Rzeszów	12	160	126	2(2)	20209	1316	15.4
Toruń	13	205	98	1	20091	1058	19.0
Kielce	14	214	87	4(1)	18718	1042	18.0
Bydgoszcz	15	386	46	4	17744	1558	11.4
Częstochowa	16	259	58	3	15076	936	16.1
Olsztyn	17	168	89	2(1)	15017	1447	10.4
Opole	18	130	106	2	13719	957	14.3
Radom	19	233	45	3	10574	507	20.9
IVth order							
Koszalin	20	112	76	2	8551	405	21.1
Słupsk	21	103	53	2	5447	389	14.0
Siedlce	22	75	72	1(1)	5427	471	11.5
Stalowa Wola	23	72	73	(1)	5251	—	x
Płock	24	127	38	1(1)	4848	178	27.2
Cieszyn	25	37	121	(1)	4481	164	27.3
Pułtusk	26	19	234	1	4440	77	57.7
Łowicz	27	32	131	1	4194	51	82.2
Vth order							
Bielsko-Biała	28	180	20	3(2)	3677	270	13.6
Piotrków Tryb.	29	81	40	(2)	3289	89	37.0
Jelenia Góra	30	94	29	(2)	2685	89	30.2
Olecko	31	17	95	1	1621	20	81.1
Gorzów Wlkp.	32	125	12	(2)	1449	142	10.2
Biała Podlaska	33	57	25	(1)	1422	102	13.9
Wałbrzych	34	139	10	(2)	1339	1	0
Nowy Sącz	35	82	14	1	1157	81	14.3
VIth order							
Kalisz	36	107	7	(1)	802	62	12.9
Leszno	37	62	12	1	765	—	x
Włocławek	38	123	5	1(1)	577	18	32.1
Suwałki	39	67	7	1	486	4	121.5
Zamość	40	67	7	(1)	485	25	19.4
Legnica	41	108	4	(1)	477	—	x
Zgierz	42	59	8	1	450	14	32.1
Elbląg	43	129	3	(1)	440	4	110.0
Ostrołęka	44	54	6	1	348	9	38.7
Tarnów	45	122	3	1(1)	338	11	30.7
Sieradz	46	45	7	(1)	308	—	x
Lubin	47	83	3	(1)	290	—	x
Głogów	48	74	3	1	216	—	x
Sandomierz	49	27	6	1	156	23	6.8
Zakopane	50	30	3	(1)	76	—	x
Nowy Targ	51	34	2	(1)	71	—	x
Jasło	52	39	2	(1)	64	—	x

In the column providing the numbers of schools the figures in brackets denote branches and regional departments. No military nor police schools are accounted for.

Table 2.3.

Distribution of public and private higher schools in 1995

Town	Public schools	Private schools
Totals	89	80
Warsaw	12	28
Białystok	2	1
Bielsko-Biała	—	3
Bydgoszcz	4	—
Częstochowa	2	1
Gdańsk, Gdynia	7	1
Głogów	—	1
Katowice (agglomeration)	6	5
Kielce	2	2
Koszalin	1	1
Cracow	10	5
Leszno	—	1
Lublin	4	1
Łowicz	—	1
Łódź	6	4
Nowy Sącz	—	1
Olecko	—	1
Olsztyn	2	—
Opole	2	—
Ostrołęka	—	1
Płock	—	1
Poznań	8	6
Pułtusk	—	1
Radom	1	2
Rzeszów	2	—
Sandomierz	—	1
Siedlce	1	—
Słupsk	1	1
Suwałki	—	1
Szczecin	5	3
Tarnów	—	1
Toruń	1	—
Włocławek	—	1
Wrocław	8	3
Zielona Góra	2	—
Zgierz	—	1

Without military and police establishments.

four branches in which 2116 persons study, i.e. 14% of the total number of students. The greatest numbers of students of these branches are noted in

Note: There are 32 non-state higher schools located in Warsaw province, out of which 31 in Warsaw and 1 in Podkowa Leśna by Warsaw.

Source: *Coraz bogatsza oferta. Uczelnie niepaństwowe (The expanding offer. The non-state universities)*, "Rzeczpospolita", 11 July 1997, on the basis of information from the Ministry of National Education.

Fig. 14. Spatial distribution of the non-state higher schools in 1997

Wałbrzych—990, Jelenia Góra—649, and in Legnica—477. Besides, there is in Jelenia Góra a branch of the Academy of Economics from Wrocław, where 2036 students are taught.

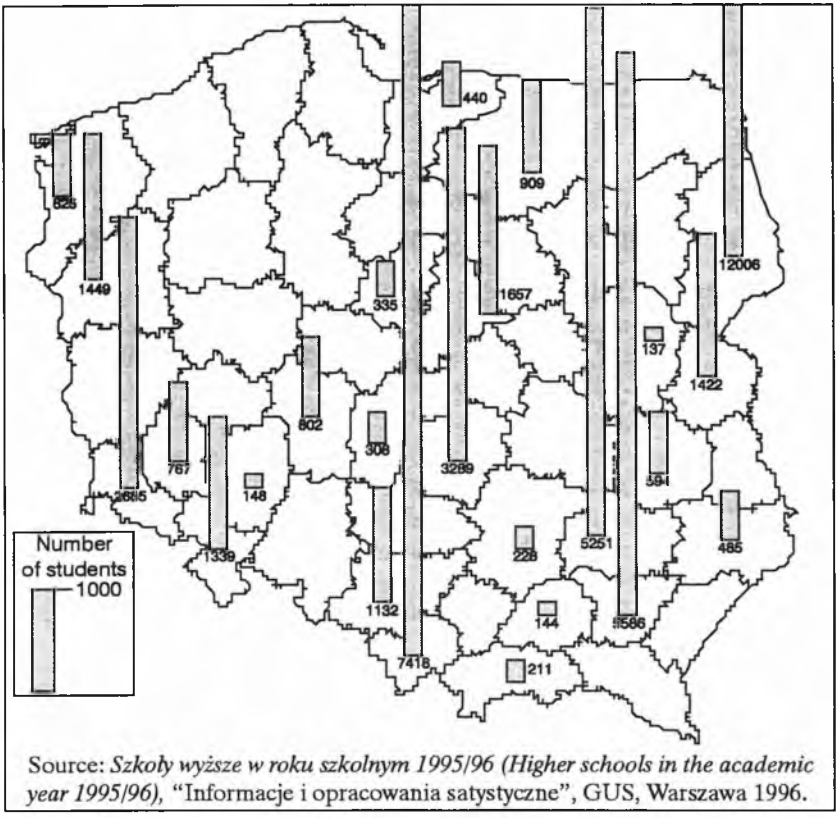
Branches function also in the artistic schools, allowing for the exchange of the teaching staff and enrichment of the educational offer, and stimulating the interregional artistic contacts. And so, in particular, the Fine Arts School from Cracow has a branch in Katowice, while the Higher School of Drama, also from Cracow, has a branch in Wrocław. Administrative authorities of the voivodships, as well as local self-governmental bodies,

Table 2.4.

Distribution of branches, departments and institutes located outside of the university seat in 1995

University seat	University	Location of branch
Warsaw	University of Warsaw	Białystok
	Musical Academy	Białystok
	Higher School of Drama	Białystok
	Academy of Sports	Biała Podlaska
	Higher Pedagogical School	Katowice
		Lublin
		Olsztyn
		Szczecin
		Wałbrzych
	Papal Theological Faculty	Siedlce
		Włocławek
	University of Technology	Płock
Gdańsk	Gdańsk Polytechnics	Elbląg
Kielce	Higher Pedagogical School	Piotrków
Katowice	Silesian University	Cieszyn
Cracow	Fine Arts Academy	Katowice
	Higher School of Drama	Wrocław
	Higher Pedagocial School	Bielsko-Biała
Lublin	Catholic University of Lublin	Stalowa Wola
	Marie Skłodowska-Curie University	Rzeszów
	Academy of Farming	Zamość
		Rzeszów
Łódź	University of Technology	Bielsko-Biała
Nowy Sącz	Higher School of Business—National Louis University	Jasło
		Nowy Targ
		Tarnów
		Zakopane
Poznań	Adam Mickiewicz University	Kalisz
	Academy of Sports	Gorzów Wielkopolski
	High School of Music	Szczecin
Rzeszów	Higher Pedagogical School	Kielce
Wrocław	University of Technology	Wałbrzych
		Legnica
		Jelenia Góra
	Academy of Economics	Jelenia Góra
	Papal Faculty of Theology	Gorzów Wielkopolski
	Academy of Sports	Lubin
Zgierz	Higher School of Commerce	Piotrków
		Sieradz

increasingly appreciate the role of higher schols for the development of their regions. They try, as far as their capacities allow, to stimulate the



Source: *Szkoły wyższe w roku szkolnym 1995/96 (Higher schools in the academic year 1995/96)*, "Informacje i opracowania satystyczne", GUS, Warszawa 1996.

Fig. 15. Numbers of students in branches, outer faculties and institutes of higher schools in 1995 according to voivodships

development of university education in the respective provinces. This involves, in particular, assistance in acquiring premises for private schools and the incentives in the form of higher standard apartments, as well as additional employment for the scientists taking up jobs in a given locality. In some voivodships their authorities make efforts aiming at the upgrading of the existing higher schools in order to link them together so as to form a proper university. This kind of effort is observed in such towns as Rzeszów, Olsztyn and Zielona Góra. Such a sort of care results from the wish of strengthening the intellectual potential of the region, and of raising its prestige, as well as enhancing the accessibility to higher education for the young of the region, since university stud-

ies closer to the place of residence are much less costly for the parents of a student than when they are undertaken in the farther located centers.

2.4. Regional centers of university education as knowledge creation agents

The volume of knowledge generated in particular scientific centers—in view of absence of other appropriate indicators—is commonly measured with the number of the conferred titles of doctor and doctor *habilitatus* (doctor of science) in all the higher schools in a given locality. This indicator is based upon the assumption that the defended respective dissertation is the result of a research effort which contributes to the broadening of knowledge in the whole domain in question. Such an assumption is certainly somewhat optimistic, because there occur such dissertations which are simple compilations and repetitions, but, nevertheless, the number of the dissertations mentioned reflects in a way the volume of new knowledge produced in a given center.

The degree of concentration of knowledge generation is even bigger than in the case of concentration of the scientific staff. While four centers of the Ist order grouped 45% of academic teachers, in the same centers almost 60% of doctoral and doctor of science dissertations were defended. Centers of the IInd order, grouping 33% of scientific staff produced approximately 36% of scientific works. Wrocław distinguishes itself in an obvious manner among the centers of the IInd order, followed by Łódź and Lublin, while Gdańsk and Szczecin play a marginal role in generation of knowledge. Altogether 92.7% of dissertations were defended in all the centers of the Ist and IInd order. Hence, the remaining centers play a minimum role in creation of knowledge. While employing 22% of academic staff they produced only approximately 8% of scientific dissertations (see Table 2.5).

Universities in the strict sense are the most powerful producers of science. In 12 schools of this type altogether 40% of general scientific dissertations and 47% of doctor of science dissertations appeared. If we add to this the universities of technology then the respective figures are 52% and 66%. Thus, and to no surprise, 12 universities and 8 technical universities produce the majority of knowl-

edge and teach almost ⅔ of the staff with the highest qualifications.

Summing up, we can state that only five centers of higher education in Poland can be classified as significant centers of knowledge creation. Three of them are located in southern Poland, one in the center, and one in the western belt. One should add that the most important research institutes of the Polish Academy of Sciences as well as other R&D institutions are also concentrated in these five centers. All in all the respective institutions located in the centers mentioned employ approximately 70% of all persons active in such activities.

Table 2.5.

Scientific degrees conferred in 1995 in individual centers

Science centers	Total for titles		Doctor of science		Doctor	
	Number	%	Number	%	Number	%
Białystok	13	0.5	8	1.5	5	0.2
Bydgoszcz	41	0.5	3	0.6	38	1.8
Gdańsk, Gdynia	122	4.6	26	4.8	96	4.5
Katowice (agglomeration)	263	9.9	31	5.7	232	11.0
Cracow	381	14.4	86	15.8	295	14.0
Lublin	197	7.4	52	9.6	145	6.9
Łódź	226	8.5	42	7.7	184	8.7
Olsztyn	47	1.8	8	1.5	39	1.8
Opole	17	0.6	4	0.7	13	0.6
Poznań	291	11.0	86	15.8	205	9.7
Szczecin	111	4.2	14	2.6	97	4.6
Toruń	52	2.0	18	3.3	34	1.6
Warszawa	568	21.4	103	19.0	465	22.0
Wrocław	301	11.3	61	11.2	240	11.4
Other centers	25	0.9	1	0.2	24	1.1
Universities	993	37.4	256	47.1	737	34.9
Totals	2665	100.0	543	100.0	2112	100.0

2.5. Universities as regional centers of innovation and technology development

During the period of "real socialism" Polish higher schools—and especially the technical ones—cooperated with the state-owned industrial enterprises in the field of implementation of new technologies and production techniques. Low propensity of the "socialist" industry to invest in

innovation caused, however, that many a creative idea coming from the research community would end up never implemented in industrial practice. The downfall of the "real socialism" entailed important perturbations in the state-owned industry. Many enterprises went bankrupt, while other ones were privatized and their new owners—usually foreign ones—introduced into these enterprises their own, imported technologies. Currently we can observe in many scientific centers the initiatives aiming at the establishment of the regional innovation networks as well as the loci of development and implementation of new technologies.

Establishment of the networks and technological centers requires simultaneous involvement of the governmental and self-governmental authorities, universities and research institutes, entrepreneurs, as well as the home and foreign NGOs. The task of these networks and centers would be to collaborate in the restructuring of the old industrial plants, assistance for the small and medium enterprises in the domain of implementation of new technologies, as well as education for the regional development.

Many scientific centers in Poland undertake efforts of this nature. Thus, for instance, four projects can be mentioned for the case of Cracow, these projects having already been realized or under realization[5]. First of them concerned restructuring of the large-scale steelworks, which employed too many people and produced at high costs, on the basis of dated technologies. As a consequence of the cooperation between the government, self-governmental institutions and scientific community, the productive core of the steelworks was separated, the remaining parts of the steelwork combine were transformed into 20 satellite companies of differing character, functioning with the capital share of the steelworks proper. Together with the commune of Cracow and the regional authorities (province governor) the Cracow-East Development Agency was established, whose task consists in appropriate use of the remaining assets of the former steelworks and of the land belonging to the commune, but located in the protective zone of the enterprise. A capital investment fund and an enterprise incubator were also established.

Another initiative consisted in the establishment, under the auspices of the Jagiellonian University, of the Academic Technological Park consortium. This consortium includes such universities functioning in Cracow as Technical University, Academy of Mining and Metallurgy, Academy of Economics, Academy of Agriculture, and the Institute of Machining. The

[5]See Jan Targalski, *System innowacji w regionie Krakowa (The innovation system in the region of Cracow;* in Polish). In: A. Kukliński, ed., *Problematyka przestrzeni europejskiej.* EUROREG, Warszawa 1997.

Academic Technological Park (ATP) will encompass scientific laboratories conducting research for the needs of industry, notably in the domains of biotechnology, genetic engineering and molecular biology. In the premises of the ATP, which are to appear until the year 2000, the workshops and laboratories will be located, in which research as well as semi-industrial implementations of new technologies will be performed.

Another example of formation of the regional networks of innovation is provided by the initiative entitled "Enterprise support in the domain of advanced technologies". This program is being realized by the foundation which was established upon the initiative of the universities from Cracow in cooperation with the Danish Institute of Technology. The company "Progress & Business Incubator", established by the foundation, aims at creation of the model for the transfer of technology from the research sphere to industry by concentration of results of scientific research and assistance extended to the undertakings based on technological innovations.

Similar initiatives appeared also in Wrocław, where the Center of Technology and Business was affiliated with the University of Technology. The tasks of the Center include: penetration of the scholarly community with the purpose of finding interesting hi-tech solutions, elaboration of the substantial assessments and feasibility studies, extending the financial support for the necessary application studies, selection of technologies which might be realistically implemented, formulation of the hi-tech offer and the related salesmanship activity, as well as definition of innovation needs in production and service. Center of Technology and Business cooperates with the British Know-How Fund program. In the framework of this cooperation formation of a technological park in Wrocław is envisaged, along with establishment of an appropriate educational program in the secondary schools[6].

In numerous university centers, like, for example, in Gdańsk, Cracow and Wrocław, construction of the university computer networks linking particular schools and their libraries into a unified computer system was undertaken.

[6]See Marek Kozłowski, *Problematyka innowacji w świetle doświadczeń regionu wrocławskiego* (*Problems of innovation in the light of experience of the Wrocław region;* in Polish). In: A. Kukliński, ed. (op. cit).

3. RESULTS OF THE SURVEY: MOBILITY OF RESEARCH SCHOLARS

3.1. Internal and external mobility

The survey studies which have been carried out already three times over show the phenomenon analysed in the period of 16 years, divided into 5 subperiods of four and three years of length at the beginning and of two years henceforth. Thus, in order to secure adequate comparability the annual means of the respective mobility figures were calculated. As shown distinctly in Table 3.1, until 1988 the number of discharges remained at a similar level of some 600 per annum, to then grow in the years 1989–1991 to approximately 800, and to reach the maximum of 1300 in the years 1992–1993. Thereafter the average annual number of discharges dropped by almost half.

The 16 year period studied is significantly differentiated in terms of the proportions of persons migrating abroad and moving over to other occupations in the country. Foreign migrations exceeded internal mobility in the subperiod 1981–1984, which, as it was indicated by us already, was linked with the political situation at that time. In the subsequent period the foreign and the home mobilities remained at a similar level. Thereafter the foreign migrations were decreasing, while home mobility increased. Finally, in the recent subperiod, 1994–1996, both of the mobility indicators were decreasing. Thus, the staffing situation of the research and university sector has been stabilizing of late. The brain drain has been replaced by the "normal" professional mobility.

The question which naturally arises concerns the reasons for this stabilization. Perhaps a certain influence was exerted by the—very limited—wage hike which took place in 1996. This influence, though, should not be overestimated, insofar as the salaries in science and the universities are still dramatically low in comparison with those in state administration and in the military, the enterprise sector put aside. A much more effective influence was, on the other hand, exerted by the establishment of numerous private higher schools, which provided additional employment to many a research scholar. Private university sector became a kind of a buffer for the research

Table 3.1.

Overall mobility of research scholars in the years 1981–1996

Mobility indicators	1981–1984	1985–1988	1989–1991	1992–1993	1994–1996
% shares in total of 11546	20.1	20.4	20.2	22.7	16.6
Average annual number of discharges	582	589	799	1306	638
In relation to the subperiod 1981–1984 in %	100.0	101.2	100.5	112.2	82.3

Table 3.2.

Foreign migrations of the research scholars in the years 1981–1996

Mobility indicators	1981–1984	1985–1988	1989–1991	1992–1993	1994–1996
% shares of the total of 3351	36.0	27.7	17.1	13.0	6.2
Average annual numbers of departures	303	230	191	217	69
In relation to the subperiod 1981–1984, in %	100.0	76.0	47.1	35.6	17.3

Table 3.3.

Internal mobility of the research scholars in the years 1981–1996

Mobility indicators	1981–1984	1985–1988	1989–1991	1992–1993	1994–1996
% shares of the total of 8195	13.6	17.5	21.5	26.6	20.8
Average annual numbers of discharges	280	286	586	1088	569
In relation to the subperiod 1981–1984, in %	100.0	127.9	156.1	194.6	152.5

and higher education sector, enabling the survival of many an institution in the public domain. It is hard to say to what extent the staff stabilization in science and the university will turn out to be a persistent phenomenon. It must be noted, anyway, that this stabilization took place at a relatively high cost and was accompanied by a number of negative phenomena. Double employment—and in many cases even more than double—entails worsening of the work quality, first of all in the public establishments, because employment outside of them is remunerated somewhat better. Lack of time for skill improvement and for own research work not only lowers the level of the academic teachers, but also delays their professional advance in terms of gaining consecutive scientific degrees and titles. Hence, there are still no reasons for optimism, in spite of the indications of a relative staff stabilization in the sphere of science and higher education.

Comparison of the consecutive years in the subperiod of 1994–1996 shows the decrease of mobility of the research scholars, with particularly distinct decrease concerning foreign migrations (by 6 percentage points in relation to 1994). It should also be emphasized that every fifth person who leaves job on own initiative moves in fact to another establishment within the sphere of science, and so the actual outflow from research and the universities is smaller by approximately 20%. Total employment in research and higher education has been increasing in the period 1994–1996 by some 1500 persons a year, with about half of that number constituted by the graduates. Thus, the science establishments fill the existing staffing gaps by employing more or less equal numbers of persons previously working in other domains and of the fresh graduates.

Table 3.4.

Mobility of research scholars in the consecutive years between 1994 and 1996

Year	Total outflow*	Foreign migration	To other institutions at home	Out of which:		Total of newly employed*	Out of which: graduates	Net balance*
				to science:	outside of science:			
1994	710	14.9	85.1	15.6	84.4	1447	50.3	+737
1995	654	8.7	91.3	18.8	81.2	1481	49.4	+827
1996	551	8.3	91.7	22.0	78.0	1555	52.2	+1004
total	1915	10.9	89.1	18.6	81.4	4483	50.7	+2568

* In absolute numbers; other positions in corresponding percentage shares.

As mentioned already, both the phenomenon of foreign migrations and the outflow to other occupations at home in the years 1994–1996 decreased significantly in all the scientific centers. Among those who left the research institutions foreign migrants constituted approximately 10%, but in Lublin this share was at 20%, and in Olsztyn even at 30%. A very low percentage share of emigrants from Warsaw is also worth emphasizing. In the light of these numbers the question arises of the potential connection between the broad and differentiated job market in Warsaw, the capital of Poland, and the respective small outmigration flow. In the provincial centers, on the other hand, where the local possibilities are much smaller, emigration turns out in some cases quite high. This regularity is not always confirmed—to cite the case of Bydgoszcz. In general, however, too far reaching conclusions should not be reached on the basis of figures cited, since the respective numbers concerning particular centers are rather small.

Similarly as in the preceding periods foreign migrations occur most often to biologists and physicists, since there is still an important demand for

the specialists from these domains on the labour markets of other countries. There has been a relative increase of the numbers of outmigrating representatives of medical and agricultural sciences, which are in a way related to biology. On the other hand, the numbers of emigrating mathematicians and computer scientists significantly decreased. It is possible that the home market opened up appropriately widely for the specialists from these domains. Attention should also be paid to a relatively large number of representatives of social sciences and humanities among the migrants (20%), who have migrated abroad much less frequently before.

Table 3.5.

Mobility of the research scholars in particular scientific centers in the years 1994–1996

Centers	Total movements	Foreign migrations	%	Internal movements	%
Warsaw	383	18	4.7	365	95.3
Cracow	202	29	14.4	173	85.6
Upper Silesia	235	22	9.3	213	90.7
Poznań	194	22	11.3	172	88.7
Wrocław	149	23	15.4	126	84.6
Lublin	69	15	21.7	54	78.3
Łódź	185	20	10.8	165	89.2
Tri-City*	110	10	9.1	100	90.9
Szczecin	60	7	11.6	53	88.4
Białystok	27	4	14.8	23	85.2
Bydgoszcz	56	2	3.6	54	96.4
Olsztyn	64	19	29.7	45	70.3
other centers	181	18	13.0	163	87.0
Totals	1915	209	10.9	1706	89.1
in % of employment in 1996	7.3		0.8		6.5

* Here and further on denotes the Gdańsk–Sopot–Gdynia agglomeration.

The greatest numbers of emigrants come from the agricultural academies, followed by the engineering schools, medical academies, proper universities and the Polish Academy of Sciences. In the preceding period the image was somewhat different, because the greatest number of persons outmigrated from the medical academies and the Academy of Sciences, while much less so from the agricultural schools and yet less from the engineering colleges. The outflow to other occupations in the country is in relative terms the greatest from the pedagogical schools, universities of technology and economic academies.

Table 3.6.

Mobility of research scholars according to institutions in the years 1994–1996

Institution type	Totals	Foreign migrations	%	Internal mobility	%
Universities proper	377	52	13.8	325	86.2
Universities of technology	384	18	4.7	366	95.3
Academies of economics	53	3	5.7	50	94.3
Medical academies	289	49	17.0	240	83.0
Agricultural academies	222	44	19.8	178	80.2
Engineering colleges	27	5	18.5	22	81.5
Higher pedagogical schools	92	4	4.3	88	95.7
Polish Academy of Sciences	219	30	13.7	189	86.3
Branch institutes	251	4	1.6	247	98.4
Totals	1914	209	10.9	1705	89.1

Table 3.7.

Mobility of the research scholars according to scientific disciplines in the years 1994–1996

Discipline	Totals	Foreign migrations	%	Internal mobility	%
Biology	77	22	28.6	55	71.4
Chemistry	108	9	8.3	99	91.7
Economics	107	3	2.8	104	97.2
Physics	85	17	20.0	68	80.0
Mathematics and computer science	89	5	5.6	84	94.4
Humanities	260	41	15.8	219	84.2
Technical sciences	526	31	5.9	495	94.1
Medical sciences	292	46	15.8	246	84.2
Geographical and natural sciences	52	3	5.8	49	94.2
Agricultural sciences	197	28	14.2	169	85.8
Social sciences and law	76	4	5.2	72	94.8
Other	46	.	.	46	100.0
Totals	1915	209	10.9	1706	89.1

3.2. Directions of migration

Every third person among those who emigrate moves to the United States, while every seventh—to Germany (see Table 3.8). Other countries are much less represented. Directions of foreign migrations are the same as in the preceding years.

A similar share of emigrants as observed in the preceding years remain in the sphere of science after having migrated. Like before, also, a greater

Table 3.8.

Migrants according to the countries of new residence

Country/category	Number of persons	% share
Total	209	100.0
United States	67	32.1
Germany	30	14.4
Canada	16	7.6
United Kingdom	12	5.7
France	6	2.9
Other European	36	17.2
Other non-European	16	9.1
Lack of data	26	12.4
Remain in science	107	51.2

Table 3.9.

Emigrants from the period 1994–1996 who are still employed in science according to centers

Centers	Number of emigrants	%	Number of emigrants employed in science	%
Warsaw	18	8.6	13	12.2
Cracow	29	13.9	21	19.7
Upper Silesia	22	10.5	14	13.2
Poznań	22	10.5	7	6.5
Wrocław	23	11.0	7	6.5
Lublin	15	7.2	8	7.4
Łódź	20	9.6	16	15.0
Tri-City	10	4.8	6	5.6
Szczecin	7	3.3	4	3.7
Białystok	4	1.9	1	0.9
Bydgoszcz	2	0.9	1	0.9
Olsztyn	19	9.2	3	2.8
Other	18	8.6	6	5.6
Totals	209	100.0	107	100.0

share of persons migrating from larger centers remain in science than of those who left the small centers.

3.3. Staff dynamics in the years 1994–1996

Similarly as in the preceding period the least mobile were the research scholars from Lublin and from Cracow, and also from Białystok, the latter not having been previously distinguished from the group of "other cen-

ters", while the greatest mobility occurred in Bydgoszcz, Poznań, Łódź and Olsztyn. Attention should be paid to the essential decrease of mobility in Warsaw, currently only slightly differing from the national average.

In terms of institutions the highest mobility was displayed by the units belonging to the Academy of Sciences, followed by the branch institutes and the academies of economics. Compared to the preceding period there has been a significant decrease of mobility of the employees of the agricultural academies. In the breakdown into the scientific disciplines the highest mobility was observed among the economists, chemists, technicians as well as mathematicians and computer scientists, while the least mobile were the representatives of natural and geographical sciences. It appears that in this case there is a distinct correlation between the mobility of the representatives of given disciplines and their position on the labour market in Poland.

One fourth of those whose left their institutions on their own will would then undertake work in private firms, Polish and foreign, and less than one fifth—in other scientific institutions. Slightly less than every tenth research employee leaving a job in science sets up an own business. In comparison with the years 1992–1993 there is a significant number of persons who, after having left their previous research institution, would continue their career in other research establishments. In the preceding period the share of such persons amounted in the majority of cases to just a couple of percentage points, while it attains now almost 20%.

The outflow of the research workers to administration was relatively the highest in Warsaw, Szczecin and Bydgoszcz, and to business—in Białystok, Upper Silesia and in Olsztyn (the lowest outflow to business was noted in Szczecin and in Tri-City). The respective figures, shown in Table 3.11, should, however, be treated carefully in view of small numbers appearing there and of an important share of persons, on whose fate we do not dispose of any information.

The largest share of persons leaving technical universities went to private firms, while employees of the academies of economices would most often take up new jobs in state administration and in banks. A relatively high share of those leaving the institutions of the Polish Academy of Sciences (almost one third) go to other scientific establishments. In this case the image is similar to the one observed in the preceding period. Similarly, a high percentage of persons giving up employment in higher engineering and pedagogical schools, as well as universities proper, remain in science (approximately one fourth of them). On the other hand, the lowest percentage of persons remaining in science come from the universities of

Table 3.10.

Internal mobility according to centers, institutions and disciplines of science

Items	Employment	% of discharges
Warsaw	5386	6.8
Cracow	3959	4.4
Upper Silesia	2452	8.6
Poznań	1486	11.6
Wrocław	3150	4.0
Lublin	1312	4.1
Łódź	1675	9.9
Tri-City	1326	7.5
Szczecin	577	9.2
Białystok	937	2.5
Bydgoszcz	460	11.7
Olsztyn	482	9.3
other	3066	5.3
Total	26268	6.5
Universities proper	5359	6.1
Universities of technology	5226	7.0
Academies of economics	522	9.6
Medical academies	4229	5.7
Academies of agriculture	2722	6.5
Higher engineering schools	764	2.9
Higher pedagogical schools	1240	7.1
Polish Academy of Sciences	2076	9.1
Branch institutes	2814	8.8
Biology	836	6.6
Chemistry	1320	7.5
Economics	1530	8.0
Physics	1024	6.6
Mathematics and computer science	1060	7.9
Humanities	3178	6.9
Technical sciences	6565	7.5
Medical sciences	4969	4.9
Geographical and natural sciences	1356	3.6
Agricultural sciences	2864	5.9
Social and law sciences	1112	6.5

technology and the medical academies. This, again, bears resemblance to the preceding period.

In terms of scientific disciplines the greatest shares of person continue their scientific careers among the biologists, naturalists, humanists and physicists. More or less every sixth representative of legal and other social

Table 3.11.

New jobs of the persons discharged at own will in the years 1994–1996 according to scientific centers, in %

Center	Total	Administration	Private firms		State enterprises	Research institutions	Own business	Banks	Other, lack of data
			Polish	foreign					
Warsaw	365	11.8	10.4	8.2	2.5	20.3	5.7	1.6	39.5
Cracow	173	9.8	15.0	8.1	3.5	22.0	6.4	1.7	33.5
Upper Silesia	213	1.8	16.4	14.6	1.9	16.9	6.1	4.7	37.6
Poznań	172	5.2	16.9	12.2	4.1	16.3	6.8	1.7	37.8
Wrocław	126	2.4	13.6	11.9	2.4	21.4	11.9	4.8	31.1
Lublin	54	5.5	14.8	9.3	11.1	14.8	16.7	5.5	22.3
Łódź	165	8.5	14.5	10.9	15.8	17.6	4.8	3.0	24.9
Tri-City	100	6.0	9.0	9.0	7.0	10.0	1.6	1.0	42.0
Szczecin	53	18.9	7.5	3.8	3.8	24.5	15.1	1.9	24.5
Białystok	23	4.3	13.0	56.5	.	8.7	8.6	.	8.9
Bydgoszcz	54	16.7	16.7	7.4	1.8	14.8	11.1	3.7	27.8
Olsztyn	45	6.7	20.0	8.9	.	24.4	13.3	2.2	24.5
Other	163	7.4	14.7	6.7	1.2	20.6	12.3	1.8	35.3
Totals	1706	6.7	14.4	10.4	4.3	18.6	8.5	2.6	34.5

Table 3.12.

New jobs of the persons discharged at own will in the years 1994–1996 according to institutions, in %

Institutions	Total	Administration	Private firms		State enterprises	Research institutions	Own business	Banks	Other, lack of data
			Polish	foreign					
Universities proper	325	5.9	14.8	7.4	2.1	22.5	5.5	2.8	39.0
Universities of technology	366	6.0	21.6	13.1	9.0	11.2	10.4	2.8	25.9
Academies of economics	50	16.0	16.0	8.0	8.0	18.0	8.0	16.0	10.0
Medical academies	240	6.3	9.6	20.0	1.7	13.3	13.3	1.3	34.5
Academies of agriculture	178	10.1	14.0	10.1	1.7	17.4	11.2	3.9	31.6
Higher engineering schools	22	4.6	18.2	13.6	9.1	22.7	—	9.1	22.7
Higher pedagogical schools	88	7.9	8.0	1.1	1.1	26.1	13.6	1.1	41.1
Polish Academy of Sciences	189	8.5	9.5	6.9	4.8	30.2	4.2	1.0	34.9
Branch institutes	247	3.6	13.8	7.3	4.0	18.6	4.9	1.2	46.6

sciences goes over to administration, the same happens to every seventh specialist in natural sciences and economics, and to every ninth biologist. Approximately every second chemist finds a job in a private firm, along with every third physicist and technician, every fourth specialist in agricultural sciences and mathematician, and every fifth physician. The highest shares of persons setting up their own businesses (almost every tenth person) occurs among the specialists in agricultural, medical and technological sciences. Finally, every tenth economist find employment in a bank. Representatives of other disciplines find employment in the banks much less frequently.

3.4. Employment structure

The phenomenon of multiple jobs in science and the university sector motivated, it seems, the central administration to make the licenses for conducting the masters studies and conferring the scientific degrees dependent upon the number of persons with primary job in a given establishment. This is a purely formal bureaucratic trick, caused probably by the wish of decreasing the extent of the phenomenon of multiple jobs among the research staff, and first of all—of limiting the number of units capable of conferring the scientific degrees. In reality the regulation mentioned is devoid of any sense, insofar as an outstanding research scholar can work better and more effectively when employed on a second job, and may contribute more to the quality of the dissertations being the basis for granting scientific degrees by a given scientific council than a mediocre employee, working there on the primary job. Still, in the conditions as of now the number of "first jobs" is the indicator of the potential of a given unit. The greatest share of persons employed on the first jobs occurs in Olsztyn, in Upper Silesia, and also in Białystok and Lublin. On the other hand, the relatively lowest percentage shares of the "first job" employments are observed in the smallest university centers (approximately two thirds), followed by Warsaw and Wrocław, i.e. by the definitely strong scientific centers.

The greatest shares of the newly employed persons (approximately every fourth employee) are observed in Łódź, Szczecin and Olsztyn. On the other hand, there is distinctly the least of the newly employed persons in Warsaw and Wrocław. Within the latter centers the establishments of science do not apparently compete effectively for labour. The percentage share of the graduates among the newly employed is about 50%. It is clearly the lowest in Warsaw and in Białystok, as well as in small academic centers.

Table 3.13.

New jobs of the persons discharged at own will in the years 1994–1996 according to scientific disciplines, in %

Discipline	Total	Administration	Private firms		State enterprises	Research institutions	Own business	Banks	Other, lack of data
			Polish	foreign					
Biology	55	12.7	5.4	18.2	3.6	34.6	1.8	—	23.7
Chemistry	99	9.1	19.9	22.2	7.7	11.1	5.1	—	24.9
Economics	104	14.4	20.2	8.6	6.7	16.3	6.7	11.5	15.6
Physics	68	7.3	23.5	14.7	4.4	26.5	4.4	1.5	17.7
Mathematics*	84	4.8	22.6	2.4	1.2	20.2	5.6	7.1	36.1
Humanities	219	3.6	4.1	3.6	1.4	28.8	8.7	1.4	48.4
Technical sciences	495	3.6	18.3	11.5	7.9	14.9	9.9	2.0	31.9
Medicine	246	3.2	6.1	14.2	1.2	11.8	10.9	1.2	51.4
Geography**	49	14.3	8.2	6.1	4.1	30.6	4.1	4.1	28.5
Agriculture	169	11.8	17.7	10.1	1.8	18.3	11.2	2.3	26.8
Social sciences and law	72	16.7	19.4	4.2	1.4	19.4	6.9	—	32.0
Other	46	4.6	11.4	2.3	4.6	20.5	6.7	4.6	45.3

* and computer science; ** and natural sciences.

The situation observed now in Warsaw is very similar to the one which existed in the years 1992–1993, when the lowest percentage of graduates was also being employed in the capital of Poland. This certainly is the consequence of the specific features of the Warsaw labour market, on which the scientific institutions are little competitive. An opposite situation exists now—and has existed before—in Białystok and in small centers, since, it seems, the supply of the graduates fit for work in the scientific institutions is relatively small there.

There were relatively less of foreigners among the newly employed than in the preceding period (6% as compared to 10% in the years 1992–1993). Like before, the highest numbers of foreigners were observed in the smallest scientific centers and then also in Upper Silesia. A new phenomenon is constituted by the almost twofold increase of the employment of foreigners in Warsaw. Still, though, the number of foreigners is small, and their share in total employment amounts to just 1%.

The lowest percentage share of persons employed on "first jobs" is observed in the universities of technology, branch institutes, high engineering schools and in Polish Academy of Sciences. On the other hand, the highest share of so employed persons exists in the academies of agriculture. The greatest numbers of newly employed occur in the academies of economics and the universities of technology, while the smallest—in the universities proper. Then, the universities proper, as well as the academies of agri-

culture and engineering schools employ relatively many more graduates, while the higher pedagogical schools employ the least of graduates among all the kinds of scientific institutions. In the years 1992–1993 universities employed the greatest number of graduates, while the least of graduates were employed, like nowadays, by the branch institutes and the higher pedagogical schools. Quite a distinct change took place in the universities of technology, where graduates have constituted before ⅔ of all persons newly employed, while currently—less than half. Generally speaking, the scientific institutions employ now the identical percentage of the graduates as before, namely 50%. The greatest numbers of foreigners are employed, like in the preceding period, at the universities and in the pedagogical schools. The universities of technology follow now, however, closely in this ranking, while previously they employed significantly less of foreigners.

Table 3.14.

Employment according to centers in 1996

Centers	Total employment	"First jobs" in %	Newly employed in %	Graduates employed*	Foreigners	
					Number	%
Warsaw	5386	84.5	12.6	37.9	36	13.8
Cracow	3959	91.9	18.5	62.4	24	9.1
Upper Silesia	2452	96.1	20.8	46.4	34	12.9
Poznań	1486	90.1	18.8	65.9	21	7.9
Wrocław	3150	89.9	13.1	51.9	9	3.4
Lublin	1312	95.7	16.5	52.1	8	3.0
Łódź	1617	92.4	25.9	49.0	17	6.4
Tri-City	1326	92.5	16.6	57.7	10	3.8
Szczecin	577	92.7	25.1	54.5	5	1.8
Białystok	937	95.9	25.1	39.5	9	3.4
Bydgoszcz	460	90.9	22.4	60.2	11	4.2
Olsztyn	482	98.1	25.3	56.5	14	5.3
Other	3066	68.2	18.9	44.9	66	25.0
Totals	26268	88.3	17.1	50.7	264	100.0

* In % of the total of newly employed.

The lowest percentage of the "first job" employment is encountered among the physicians and biologists, while the highest—among agricultural specialists and physicists. The greatest numbers of newly employed occur among the economists and technicians. When we compare these data with the information contained in the preceding tables we can conclude that the highest staff mobility characterizes economists and technicians, since the greatest numbers of representatives of economic and technological

Table 3.15.

Employment according to institutions in 1996

Institutions	Total employment	"First jobs" in %	Newly employed in %	Graduates employed*	Foreigners	
					Number	%
Universities proper	5359	93.2	14.6	61.5	98	37.6
Universities of technology	5226	78.7	21.4	47.6	45	17.2
Academies of economics	522	93.7	23.4	47.5	1	0.4
Medical academies	4229	91.2	15.4	45.7	24	9.2
Academies of agriculture	2722	95.4	19.7	63.6	18	6.9
Engineering schools	764	90.6	14.7	62.5	5	1.9
Pedagogical schools	1240	91.9	18.8	44.2	39	14.9
Polish Academy of Sciences	2076	90.8	17.1	43.8	21	8.0
Branch institutes	2814	82.2	13.6	35.9	10	3.8

* In % of the total of newly employed.

sciences leave their places of work within the sphere of science and get employed in them. The greatest shares of the graduates among the newly employed are noted among the chemists, physicists and biologists, while the lowest ones—among technicians and physicians. More than ⅓ of the employed foreigners represent humanities, almost exclusively employed on the language faculties. Close to one fifth of foreigners are employed in technical sciences, while every twelfth of them is a mathematician or a computer scientist.

Foreigners work in 131 scientific institutions, i.e. in approximately 13% of all the units considered in the study, and they come from a couple of dozens of countries of the world. The greatest group (one fifth of all foreigners) is constituted by persons coming from Ukraine, followed by those from Russia (every tenth foreigner) and Belarus' (every twentieth). The persons coming from the former socialist countries constitute more than half of all foreigners employed in Poland. Besides this, more or less every tenth foreigner employed in Polish science is a German, and every twelfth came from USA or Canada.

When we compare the structure of employment according to the data gathered due to our survey with the structure provided by GUS[1] we can notice a significant degree of agreement between these two structures, in

[1] *Szkoły wyższe w roku szkolnym 1995/1996 (Universities in the academic year 1995/1996)*, GUS, Warszawa 1996.

Table 3.16.

Employment according to scientific disciplines in 1996

Disciplines	Total employment	"First jobs" in %	Newly employed in %	Graduates employed*	Foreigners	
					Number	%
Biology	836	83.6	15.2	70.9	3	1.1
Chemistry	1320	94.1	18.8	77.0	4	1.5
Economics	1530	89.9	21.9	61.2	12	4.6
Physics	1024	95.1	13.8	70.9	15	5.7
Mathematics**	1060	92.5	13.5	64.3	19	7.2
Humanities	3178	90.9	16.9	43.8	95	36.2
Technical sciences	6565	82.8	20.0	40.5	50	19.0
Medicine	4969	83.1	14.8	41.7	25	9.5
Geography & natural sciences	1356	94.7	11.7	56.8	15	5.7
Agricultural sciences	2864	95.5	16.0	64.4	10	3.8
Social sciences and law	1112	94.6	18.0	47.0	15	5.7

*Share in the total of newly employed.
**and computer science.

Table 3.17.

Foreigners employed according to the country of origin

Country	Number	% share
Total	264	100.0
Ukraine	53	20.0
Germany	31	11.8
Russia	26	9.8
USA and Canada	21	8.0
United Kingdom	15	5.7
Belarus'	15	5.7
Czech Republic	14	5.3
Other post-socialist	34	12.9
Other	55	20.8
Number of units employing foreigners	131	12.6 of all units

spite of the fact that the data of GUS do not include the institutes of the Academy of Sciences nor the branch institutes. Thereby we dispose of the proof for a high reliability of the results obtained from our studies. The percentage share of professors in our survey was 16.2% (according

to GUS: 17.2%), of adjoint professors: 3.8% (GUS: 1%). The difference results from the fact that the percentage of adjoint professors in the units of the Polish Academy of Sciences and in the branch institutes is much higher than in the universities. The share of associate professors in our sample was 38.7% (GUS: 31.1%), while that of research assistants: 34.2% and 27.1%, respectively.

The lowest share of research assistants in the employment structure is observed in large academic centers, such as Warsaw, Cracow and Wrocław, and in the smallest centers (see Table 3.18). These data confirm the information contained in the preceding tables, which presented the employment levels of graduates. The highest shares of research assistants are observed in the medium sized centers, like Białystok, Szczecin and Bydgoszcz. The highest share of assistant professors, on the other hand, is noted in Wrocław (half of the employees). Similarly high shares of this category of employees are observed in Cracow and Łódź. The least of the assistant professors (slightly more than a quarter) are employed in the smallest academic centers. Every fifth staff member in Poznań and Olsztyn is a professor, while the lowest proportion of professors (every ninth employee) characterizes the scientific institutions in Białystok, and only—relatively—slightly more of them work in Upper Silesia.

Table 3.18.

Employment structure according to centers in 1996 (in %)

Centers	Totals	Research assistants	Assistant professors	Adjoint professors	Professors	Other & no data
Warsaw	5386	26.3	37.1	7.2	15.9	13.5
Cracow	3959	29.6	44.2	9.8	15.1	1.3
Upper Silesia	2452	34.1	40.4	3.4	13.3	8.8
Poznań	1486	31.7	35.0	4.4	20.0	8.9
Wrocław	3150	26.5	50.3	2.1	15.8	5.3
Lublin	1312	33.2	40.5	5.1	18.2	3.0
Łódź	1675	32.7	41.4	2.3	15.0	8.6
Tri-City	1326	30.5	36.2	5.1	16.1	12.1
Szczecin	577	39.2	33.3	1.6	19.9	6.0
Białystok	937	43.9	28.8	0.9	11.6	14.8
Bydgoszcz	460	38.0	34.8	1.1	18.0	8.1
Olsztyn	482	34.4	33.4	1.9	20.1	10.2
Other	3066	28.5	26.9	0.8	18.9	24.9
Totals	26268	34.2	38.7	3.8	16.2	7.1

The share of research assistants is the lowest—in the institutional cross-section, see Table 3.19—in the higher engineering schools (every fifth staff member is a research assistant), in the Polish Academy of Sciences and in the universities of technology (where approximately every fourth employee is a research assistant), while their share is the highest in the medical academies. Then, the highest proportion of assistant professors (more than half) is employed in the higher engineering schools, while the lowest proportion (one third)—in the higher pedagogical schools. Adjoint professors are employed primarily in the Polish Academy of Sciences and in the branch institutes. This results, first of all, from the possibility of employing doctors of science as professors at the universities. The highest proportions of professors are observed within the universities proper and in the higher engineering schools. In the latter case this may be the result of employment of practitioners at ("contractual") professors' positions. The smallest shares of professors (two times lower than at the universities) are noted in the medical academies and in the branch institutes.

If we now consider the disciplines of science, an important differentiation of the employment structure can also be noted (Table 3.20). The lowest share of research assistants is employed in physics (one fifth) and in technology (a quarter). The highest proportion of the research assistants, on the other hand, is noted in medical sciences, as it was anyway already observed for the medical academies. The highest proportion of assistant professors exists among physicists and technicians. Then, the highest proportion of professors (every fifth staff member) exists among physicists, economists and humanists. The least share of professors is noted in medical and technical sciences.

Approximately 15% of the research employees (3843 persons) declared additional employment, outside of the home institution (institution of the "first job"). The greatest percentage share of persons with multiple jobs was observed in Upper Silesia and in the smallest scientific centers. The lowest shares of such persons (working—also—outside of their home institutions) were observed in Cracow, Wrocław and Olsztyn. If, on the other hand, we consider the institutional cross-section, the persons declaring multiple jobs are most frequently encountered in the academies of economics (every third of the employees) and in the higher pedagogical schools (approximately every fourth of them).

Multiple jobs are most frequent among the economists, since almost half of them declare having jobs outside of their home institutions. Somewhat less frequently (every fourth employee) the second and further jobs are taken up by the humanists, followed by physicians as well as lawyers and

Table 3.19.

Employment structure according to institutions in 1996 (in %)

Institutions	Totals	Research assistants	Assistant professors	Adjoint professors	Professors	Other & no data
Universities proper	5359	28.5	36.8	2.8	22.1	9.8
Universities of technology	5226	26.1	38.4	1.4	14.4	19.7
Academies of economics	522	34.6	37.0	3.4	21.1	3.9
Medical academies	4529	40.1	40.0	1.8	11.7	6.4
Agricultural academies	2722	32.5	40.1	2.3	17.6	7.5
Higher engineering schools	764	20.7	52.1	3.4	22.1	2.7
Higher pedagogical schools	1240	33.1	34.1	0.7	19.6	12.5
Polish Academy of Sciences	2076	24.1	35.5	13.1	17.1	10.1
Branch institutes	3814	29.3	38.2	8.2	11.2	13.1

Table 3.20.

Employment structure according to scientific disciplines in 1996 (in %)

Disciplines	Totals	Research assistants	Assistant professors	Adjoint professors	Professors	Other & no data
Biology	836	33.4	37.2	6.7	17.1	5.5
Chemistry	1320	31.5	40.4	4.5	15.0	8.6
Economics	1530	33.3	32.4	3.1	20.1	11.1
Physics	1024	22.2	46.1	3.7	20.7	7.3
Mathematics*	1060	29.4	38.2	2.5	17.5	12.4
Humanities	3178	30.4	35.3	2.6	20.2	11.5
Technical sciences	6565	25.1	41.1	3.9	14.8	13.1
Medicine	4969	38.0	38.2	2.3	11.1	10.4
Geography and natural sciences	1356	29.9	38.8	8.9	17.2	5.2
Agricultural sciences	2864	29.2	39.7	4.7	16.7	9.7
Social sciences and law	1112	29.5	36.8	2.6	23.5	7.6

* and computer science.

social scientists (approximately every fifth employee). The phenomenon of multiple jobs is the least frequent among the physicists and the representatives of agricultural sciences.

These results confirm the earlier data (Suchocka, 1997), according to which no revenues other than the basic wage are acquired by only approximately 13% of masters of science, 11% of doctors, and 9% of doctors of science and professors. And so, for instance, among the doctors of science and professors the greatest proportions of persons acquire their additional revenues from publications, consulting and analyses (more than 60%), lectures in other scientific institutions (44%), part-time work in

other scientific institution (18%) and from free-lance work in science (approximately 10%).

3.5. The system of financing of the research institutions

In distinction to the previous studies the financing in the form of the "unit oriented funding" was broken up into the "statutory" and "own" research, and so the data are not entirely comparable. More or less one fifth of the institutions, i.e. slightly more than before, do not obtain the "unit oriented funding" in its "statutory" part. The means within this chapter are apportioned by the State Committee for Scientific Research (KBN) according to the category assigned a given unit[, corresponding to the evaluation of the scientific level of this institution]. Thus, the category "D" units do not obtain any such funding. A bit more than every second institution does not receive grants, while this proportion was at approximately ¼ before. Ministries other than KBN finance—in a very limited degree—every seventh unit, while the enterprises—every fifth. Similarly, every seventh unit takes part in foreign programs and projects, but the respective funds are marginal, ranging between 1% and 20% of the total financial resources of the units involved. A more important contribution from the side of the enterprises (more than 20% of disposable means) is being declared by more or less every thirteenth unit, while grant-related funds finance in more than 20% the expenditures of every fourth institution.

We were also interested in the shares of the individual sources of funds in the budgets of institutions, academic centers and scientific disciplines (see Table 3.23). We considered just four kinds of sources, namely: statutory research, grants, contracts from enterprises and foreign programs. And so, the statutory research funds contribute the most to the funding of activity in Białystok and Lublin, followed by Wrocław and Upper Silesia, while their shares are the smallest in Olsztyn, Bydgoszcz and Poznań. The contribution of grants is the highest in Poznań, Wrocław and Cracow, and the lowest in Białystok and Bydgoszcz. The contribution from the contracts with enterprises, generally marginal, is the most important in Cracow, Upper Silesia and Warsaw. The input from the foreign programs is yet smaller, and it is the most pronounced (some 4–5% of the totality of means) in Łódź, Warsaw and Szczecin.

The budget of the institutes belonging to the Polish Academy of Sciences is composed in approximately two thirds of the statutory funds, while in other units this share is about one third, though in the higher engineer-

Table 3.21.

Research scholars employed outside of their home institutions in %

Centers/institutions/disciplines	% shares
Warsaw	19.3
Cracow	8.9
Upper Silesia	25.0
Poznań	16.5
Wrocław	12.2
Lublin	16.2
Łódź	16.7
Tri-City	19.3
Szczecin	19.4
Białystok	19.6
Bydgoszcz	19.6
Olsztyn	12.7
Other	23.9
Universities proper	18.0
Universities of technology	9.0
Academies of economics	36.2
Medical academies	23.6
Academies of agriculture	6.9
Higher engineering schools	9.7
Higher pedagogical schools	22.1
Polish Academy of Sciences	10.4
Branch institutes	16.5
Biology	8.7
Chemistry	8.2
Economics	44.8
Physics	4.4
Mathematics and computer science	8.2
Humanities	25.6
Technical sciences	10.0
Medical sciences	22.9
Geographical and natural sciences	10.7
Agricultural sciences	5.6
Social sciences and law	21.7

ing and pedagogical schools it drops to just a quarter. Hence, the institutes of the Polish Academy of Sciences are to a large extent financed through the "unit oriented funding" mechanism, and they get an important share of funds just because they exist, in distinction to the university and other high school units, who must to a far greater extent fight for the research funds on their own.

Table 3.22.

Sources of financing of the scientific institutions in 1996. Entries contain the % shares of totality of the units considered taking advantage of a given source of financing in a given proportion

Contribution of given means in %	Statutory	Own	Grants from KBN	Other ministries	Enterprises	Foreign programs
0	22.3	28.2	55.2	86.2	78.3	83.7
1–5	1.1	4.0	4.0	4.8	4.7	6.5
6–20	10.1	22.2	16.8	5.3	8.7	6.4
21–40	23.0	27.4	13.6	2.3	4.5	1.7
41–60	24.5	11.6	8.0	0.5	2.7	1.2
61–80	12.3	3.6	1.8	0.7	0.7	0.1
81–100	6.7	3.0	0.6	0.2	0.4	0.4
Totals:	100.0	100.0	100.0	100.0	100.0	100.0

Grants contribute the most to the budgets of the higher engineering schools, the universities of technology and the academies of agriculture. Commissions from the companies constitute the highest share of the budget meant for research in the branch institutes and the technical high schools, and finally foreign programs have the greatest share in the financing of the research conducted within the universities proper.

Now, in terms of scientific disciplines the statutory part of funding contributes the most in biology, chemistry and agricultural sciences, while its contribution is the lowest in the humanities. Grants provide the greatest chunk of the respective budgets in biology, chemistry, agricultural and technical sciences. This source of financing is the least pronounced in the budgets of the social sciences, humanities and medicine. The funds coming from the enterprises have the only significant contribution in the technical sciences (some 15%), while the foreign programs have a similar financial input (between 4.2 and 3.1% of the respective total budgets) into the geographical and natural sciences, economics, chemistry, mathematics and computer science, as well as social sciences.

The contribution of the "own research", not accounted for in Table 3.23, ranges within the university sector from 16% in the higher engineering schools to 28% in the higher pedagogical schools. In the case of the Academy of Sciences this share is at mere 5%, and in the branch institutes—at 11%. The means for "own research" are in the case of universities obtained from the university authorities and are usually very limited. The share of funds coming from other ministries or sectors is in the case of universities very low—at around 1–2%. This share is, on the other hand,

Table 3.23.

The structure of the budgets of scientific centers, institutions and disciplines, in %

Centers/institutions/disciplines	Statutory research	Grants from KBN	Enterprises	Foreign programs
Warsaw	36.2	12.2	6.6	4.2
Cracow	35.9	15.0	7.2	2.5
Upper Silesia	39.2	12.2	6.7	1.1
Poznań	35.3	15.4	3.8	1.1
Wrocław	39.5	15.1	4.4	1.6
Lublin	43.5	10.0	0.9	0.6
Łódź	35.9	12.5	5.5	5.3
Tri-City	36.2	13.4	3.9	3.0
Szczecin	36.3	10.9	4.0	4.2
Białystok	47.7	4.4	2.1	3.3
Bydgoszcz	34.1	6.3	5.6	0.0
Olsztyn	32.8	13.3	1.3	1.1
Universities proper	35.2	13.0	0.8	4.1
Universities of technology	31.4	17.9	8.3	2.7
Academies of economics	36.8	11.3	4.8	2.2
Medical academies	36.8	7.7	3.0	1.8
Academies of agriculture	38.9	15.3	3.7	1.6
Higher engineering schools	29.7	21.1	15.0	2.3
Higher pedagogical schools	26.6	2.8	0.5	1.6
Polish Academy of Sciences	61.4	10.2	5.8	2.0
Branch institutes	36.8	12.7	20.9	2.8
Biology	41.6	17.8	0.6	1.7
Chemistry	41.4	17.5	4.7	3.7
Economics	38.3	11.3	5.0	3.9
Physics	38.1	15.9	1.1	2.4
Mathematics and computer science	35.7	14.0	0.7	3.8
Humanities	32.1	8.5	0.4	1.9
Technical sciences	31.3	17.6	15.1	2.8
Medical sciences	36.2	7.4	3.0	1.5
Geographical and natural sciences	39.1	9.8	4.1	4.4
Agricultural sciences	41.3	16.3	3.4	1.8
Social sciences and law	39.9	6.5	0.3	3.1

Note: the table does not account for "own research", commissions from other ministreis and sectors, nor lacks of data.

somewhat higher in the branch institutes (7%) and in the institutes of the Polish Academy of Sciences (6%).

On the basis of our inquiry it is not possible to determine which center, kind of institution or scientific discpline receives the greatest number of grants. The table presented provides only the information on the shares

of particular items in the total budgets of respective [aggregate] units. The information thus established allows, though, to draw certain general conclusions concerning the preferences enjoyed by the particular kinds of institutions and scientific disciplines.

Thus, among the institutions it is the Polish Academy of Sciences that enjoys undoubtedly the highest priority. The budgets of the institutes of the Academy are in approximately ⅔ constituted by the "unit oriented" funding. The contribution of the enterprises to the financing of science is generally very low and it is significant only in the cases of branch institutes and higher engineering schools.

In terms of scientific disciplines a clear preference is assigned to biology and chemistry, where the shares of the "statutory research" and grants cover together approximately 60% of the respective budgets, with only slightly smaller share characterizing agricultural sciences. The contribution of grants is also quite significant in technical sciences, although in this case the share of the "unit oriented" funding is smaller, while the input from the enterprises is, as mentioned already, higher.

4. ATTITUDES AND OPINIONS OF THE EMIGRANTS

After the first report on the brain drain from Polish science had been published it appeared interesting to us to show in a more detail the further fate of the emigrants. In the meantime the Directory of Polish Science started to publish the addresses of the scientists of Polish origin. We took advantage of this list of addresses and sent out the questionnaire of the survey, trying to reach the persons who left Poland after having graduated here[1]. We tried to acquire the opinions on the reasons for leaving Poland, the assessment of the current conditions of professional development against the background of such conditions in Poland, an evaluation of the state of Polish science against the background of the level of science in the country of residence, and information on the potential contacts with Polish science.

Altogether 102 filled questionnaires came back, constituting the basis for the further analyses. The degree of representation of the results thus obtained is, alas, hard to assess, and so the results outlined here should be treated as an initial probe into the domain of study.

4.1. Characterization of the group studied

The group involved is dominated by men, since only 16 out of the 102 filled questionnaires were sent back by women. The average age of the respondents was 55 years. Out of the total of 102 there were 26 persons who left before 1969, 18 persons who left during 1970s, while as many as 55 left the country during the rule of the martial law. Thus, it is clearly visible that this period influenced the decisions on foreign migration.

The greatest group of respondents live in Western Europe—47 persons. In the USA and in Canada—38 persons. Among the current residents of Western European countries the strongest group is constituted by those who went to France (14 persons).

[1]Two copies of the questionnaire were sent to every address from the Directory, accompanied by the request of forwarding the other copy to other persons in a similar situation.

With respect to scientific specializations the social sciences and humanities have the largest representation (35 persons), followed by the mathematical and physical sciences (19 persons), chemistry and biology (16 persons), and medicine (14 persons). Vast majority of the respondents work at the universities (79 persons), a part of them in the research institutes (15), and the remaining ones in consulting firms, as well as in other institutions. More or less one third of the emigrants (30 persons) were masters of science when leaving Poland, 40 of them were doctors, 22—doctors of science, and eight—professors. Thus, the majority of those migrating abroad had at the instance of leaving Poland already certain scientific accomplishments and a definite professional position. Thereby our previous observations on the significant losses which Polish science suffered due to foreign migrations, especially during the 1980s, were confirmed.

The careers of the majority of the responding migrants went successfully, insofar as they got professionally promoted during their stay abroad. Currently, 45 persons work on professorial positions, and 18 of them occupy the top managing posts in the scientific establishments.

Table 4.1 suggests that the share of masters of science (relatively fresh graduates) among the persons migrating abroad has been decreasing, while the shares of doctors and doctors of science have been increasing. The share of scientists with the highest degrees increased especially visibly after 1980.

Table 4.1.

Scientific degrees of the emigrants at the instance of outmigration and the time of outmigration

Time of leaving Poland	Total number of emigrants	Outmigrating masters of science	Outmigrating doctors and doctors of science
until 1969	26	14	12
between 1970 and 1980	18	5	13
after 1980	55	10	45

4.2. Motivations for emigrating

Table 4.2 brings together information on the reasons for outmigrating, and its contents suggests that the principal reason was the need for self development and professional self-realization. The second reason for leaving Poland was the strife for freedom and free expression of own views. The desire of improving one's living standard was, it appears, a relatively less important cause for the decision of emigration.

Table 4.2.

What were the reasons of your outmigration from Poland? Answers in %

Reasons	Very important	Quite important	Little important	Lack of answer
Possibility of free expression of one's views	39	14	20	28
Improvement of the standard of living	16	35	24	26
Family situation	27	12	32	30
Increased professional development capacities	60	14	6	21

In terms of the motivation theory the decisions taken by the deciding agents are related to the material, social and self-realizaton needs. The results of respective studies demonstrate that the most frequently declared motivation in Poland is the desire of improving the standard of living and of satisfying the social needs, related to family life. Against this background the group analysed by us appears as quite distinct from the rest of the society, insofar as the self-realization and freedom-related motivations play the disproportionately big role in this group.

There is an interesting relation between the time of migration and the reasons for this decision (Tables 4.3 and 4.4). The political reasons were stronger among the older emigrants than among those who left after 1980, since in the first subgroup the political reasons for outmigrating were considered "very important" by some ¾ of the respondents, while in the second subgroup these reasons were deemed to be very important by less than half of respondents. On the other hand, the strength of the motivation connected with the improvement of the standard of living changes with time in the opposite direction: among the emigrants from the earlier period only one person considered this motivation to be very important, while among those who left later on—15 persons.

Table 4.3.

Time of emigration from Poland and the declaration of the possibility of free expression of own views as the reason for leaving the country, in absolute numbers

Time of emigration	Number of emigrants	Declared strength of motivation:		
		very important	quite important	inessential
Until 1980	29	21	5	3
After 1980	43	18	9	16

Thus, with time, the significance of the freedom-related motivations for outmigration has been decreasing, while the significance of the material motivations has been increasing. This would not be a surprising result were

it obtained before and after the change of the system. In the case at hand, though, we may be dealing with the change of motivations brought about by the evolution of the system of values among the emigrants and in the Polish scientific community. The scholars studying Polish emigration indicate quite significant behavioral differences among Polish emigrants in, for instance, United States. These differences are being linked with the time of outmigration and the division into the "old" and "new" emigration is being emphasized. The data presented here seem to confirm those observations. It is out of question that the conditions of scientific work in the socialist Poland have been undergoing certain change. After 1980, in spite of the martial law, the policies of the state were less oppressive. And so, in particular, the censorship with respect to low-circulation scientific publications was significantly limited. In such a situation the feeling of deprivation with respect to the need of freedom might have gotten somewhat diminished and therefore stopped to be considered a primary motivation for migrating abroad.

Table 4.4.

Time of emigration from Poland and the declaration of the possibility of improving one's standard of living as the reason for leaving the country, in absolute numbers

Time of emigration	Number of emigrants	Declared strength of motivation:		
		very important	quite important	inessential
Until 1980	23	1	13	9
After 1980	51	15	22	14

4.3. Situation of the emigrants. Polish science against the background of world science

The data obtained from the survey and summarized in Table 4.5 illustrate the change of professional position and perspectives of the emigrants. These data imply that there has been a dsitinct improvement with this respect once the persons involved had left the country. All the assessments of the features of the workplace contained in the table demonstrate that the emigrants found better work conditions abroad than they had had in Poland. The relatively lowest score was assigned the evaluation of the work in the foreign research teams, whose quality, in the opinion of our respondents, does not diverge much from that which they had experienced during their work in Polish scientific institutions.

The responses obtained indicate that the conditions of work in Polish scientific institutions were clearly worse than in the current place of employment of the respondents. The greatest gap between the foreign and Polish scientific institutions is noted with regard to work organization. A somewhat smaller distance exists in the domain of possibility for exchange of ideas and concepts.

Table 4.5.

Average evaluations of various aspects of the current and previous (Polish) work place; values given are weighted averages of scores assigned, ranging between 1—"very bad" and 5—"very good"

Aspects of the workplace	Present workplace	Lack of data	Workplace in Poland	Lack of data
Conformity of work with scientific ambitions	4.4	5	3.2	14
Possibilities of intellectual development	4.3	7	3.5	16
Possibility of exchange of ideas and concepts	4.2	7	3.0	18
Collaboration in a research team	3.4	9	3.2	19
Work organization	4.4	8	2.3	16
Total of responses	102			

Let us now look at the opinions concerning Polish science as perceived against the background of the world science in various scientific disciplines. These opinions are shown in Tables 4.6–4.10. Thus, first, the data provided indicate that the relatively greatest gap in the assessment of the climate of scientific work, in terms of exchange of ideas and concepts (Table 4.6) exists in chemistry and biology, as well as in technical sciences. It is interesting to note that in case of humanities the respondents evaluate this climate as better in Poland than in the country of their current residence.

It is worth noting that against the background of the more positive assessments of the employment places abroad than in Poland the interpersonal relations in scientific teams at home are not at all badly evaluated. Hence, let us look at the situation existing in six domains of science, as to which the sufficiently large groups of persons pronounced their opinion for drawing some conclusions. And so, the representatives of three broad domains, i.e. chemistry and biology, humanities and technical sciences, are of the opinion that cooperation within the research teams was better in Polish scientific institutions than in their current places of work abroad. In the remaining cases the respondents provided somewhat better assessments of their current places of employment. The lowest evaluation of the level of collaboration in Polish scientific teams was provided by the representatives of medical sciences.

Table 4.6.

Average evaluations of the possibility of exchanging concepts and ideas in the current place of employment and in Poland according to scientific discplines, score scale from 1 to 5

Disciplines of science	In current place of work		In Poland	
	Average score	Number of responses	Average score	Number of responses
Chemistry and biology	4.5	14	2.6	14
Economic and social sciences	4.3	17	2.9	17
Mathematical and physical sciences	4.5	15	3.3	15
Humanities	3.3	10	4.1	10
Technical sciences	4.5	12	2.6	12
Medical and natural sciences	4.3	13	2.8	13
Other disciplines	3.5	12	2.0	3
Lack of response	7		18	

Table 4.7.

Average evaluations of team collaboration in the current place of employment and in Poland according to scientific discplines, score scale from 1 to 5

Disciplines of science	In current place of work		In Poland	
	Average score	Number of responses	Average score	Number of responses
Chemistry and biology	3.4	16	3.6	16
Economic and social sciences	3.4	16	2.8	16
Mathematical and physical sciences	3.7	18	3.3	15
Humanities	2.9	13	3.3	9
Technical sciences	3.5	14	3.8	12
Medical and natural sciences	3.7	13	2.3	13
Other disciplines	3.0	3	4.0	2
Lack of response	9		19	

The results of the studies prove that the respondents consider as better the possibilities of scientific development they were offered abroad in comparison with those they had had in Poland. There is, however, one exception to this rule. The representatives of humanities maintain that they had had in Poland the same possibilities of scientific development as the ones they encountered abroad. Besides this, the representatives of mathematical and physical sciences are of the opinion, on the average, that foreign scientific institutions offer only slightly better chances of development than they had had in Poland.

Analysis was also carried out of the relation between, on the one hand, the place of work and the date of emigration, and, on the other hand, the

Table 4.8.

Average evaluations of the possibility of own professional development in the current place of employment and in Poland according to scientific disciplines, score scale from 1 to 5

Disciplines of science	In current place of work		In Poland	
	Average score	Number of responses	Average score	Number of responses
Chemistry and biology	4.4	16	3.3	16
Economic and social sciences	4.2	17	3.4	17
Mathematical and physical sciences	4.1	16	3.8	14
Humanities	4.1	15	4.1	10
Technical sciences	4.4	14	3.2	13
Medical and natural sciences	4.3	13	3.7	13
Other disciplines	4.0	4	2.3	3
Lack of response	7		16	

evaluations of the places of work. It turned out, however, that in both these cases there were no significant differences nor tendencies.

Let us look now at the assessments made by the respondents regarding the level of Polish science against the background of the level of science in the world.

The evaluation of the state of Polish science indicates that in all the domains subject to consideration the level of science in Poland does not compare positively with the level of development of science in the countries, in which the respondents are currently employed. The respective differences do not take, however, any truly significant dimensions, since the level of Polish science, in the opinion of the respondents, is only slightly lower than the average level of science in the countries of their current employment. The situation is relatively the worst in Poland in the domain of practical usefulness of the research results. The subsequent table (Table 4.10) presents the same relative assessment of the advancement of science in Poland as in Table 4.9, but in the breakdown into scientific disciplines, represented by the respondents.

Theoretical advancement of Polish science gets the highest evaluation in the case of humanities (score of 2.7), and of the mathematical and physical sciences (2.6). The inherent character of the score scale applied causes that in the case of the three disciplines mentioned the evaluated level of Polish science, although formally appearing as somewhat lower than abroad, clearly tends towards the category "the same". The level of theoretical advancement of Polish science is evaluated as relatively the lowest by the representatives of economic and social as well as medical sciences (scores 1.8 each). In both these cases there is a distinct tendency

Table 4.9.

Average evaluations of the level of development of own discipline of the respondent in Poland as compared to that in the current country of residence; scale: 1—"much lower", 2—"somewhat lower", 3—"the same", 4—"higher"

Aspects of development level characterization	Average score	Lack of data
Theoretical advancement	2.3	2
Scientific quality of publications	2.1	2
Adequacy of research directions to the mainstream world science	2.1	2
Originality of research subjects and publications	2.2	6
Practical utility of research results	1.9	8
Use of results from other scientific disciplines (interdisciplinarity)	2.1	8

Table 4.10.

Average assessment of the own scientific discipline in Poland as compared to the level attained abroad; score scale: 1—"much lower", 2—"somewhat lower", 3—"the same", 4—"higher"

Disciplines	Theoretical advancement	Publication level	Mainstream research*	Originality	Practical utility	Interdisciplinarity
Chemistry and biology	2.2	1.8	2.1	2.1	1.6	2.3
Economic and social sciences	1.8	2.1	1.9	2.0	1.8	1.6
Mathematical and physical sciences	2.6	2.2	2.1	2.2	1.8	2.1
Humanities	2.7	2.6	2.1	2.7	3.1	2.4
Technical sciences	2.6	2.1	2.2	2.3	1.6	1.8
Medical and natural sciences	1.8	1.9	2.1	2.0	1.9	2.2
Other	2.0	1.8	2.0	1.8	1.5	2.0

* Degree of adequacy of research to the world mainstream scientific advance.

towards evaluating the theoretical advancement of the respective domains in Poland as decidedly lagging behind the world level.

The scientific quality of the publications gets the highest scores in the case of humanities (average score of 2.6). The responses obtained indicate in principle the tendency to the assessment of the level as "the same", though this tendency is not very well pronounced. The quality of publications gets the lowest rating in the domains of chemistry and biology, and also in medical sciences, with the tendency towards the evaluation of this quality as "much lower".

The degree of adequacy to the world mainstream research is not very much differentiated across the scientific disciplines. The highest ratings were assigned to the humanities (2.3), while the lowest ones—to economic and social sciences (1.9).

The originality of the research subjects is evaluated as the highest in the domain of humanities (2.7), which means that there is a definite tendency towards stating a similar level of originality of scientific research at home and in the country of current employment of the respondents. On the other hand, the lowest evaluations in terms of originality of research were assigned by the respondents coming from the medical and the economic and social sciences (2.0 each), followed by chemistry and biology (2.1).

Practical usefulness of research results does not seem, alas, to be in any way a strong point of Polish science. It may seem surprising that the highest rating was given with respect to this aspect by the representatives of the humanities. The persons involved assessed the practical utility of the studies conducted by Polish humanists as at least the same as that in the countries of their current employment. This may happen to result from the fact that practical usefulness of results in such disciplines is hardly measurable and its significance is primarily of a "generally cultural" dimension. The lowest scores as to the practical usefulness were assigned in the technical sciences, and in chemistry and biology (1.6 in each of the two). This situation is especially disadvantageous from the point of view of contribution of science to economic development.

The highest appraisal of the interdisciplinarity of research was expressed by the representatives of humanistic sciences (average score of 2.4), while the lowest ratings were given by the representatives of economic and social sciences (1.6), as well as technical sciences (1.8).

Let us close these remarks with the summary evaluation of the individual scientific disciplines in Poland. This summary evaluation was obtained through averaging of the scores given the particular disciplines in the individual assessment categories here considered.

Persons, who responded to our survey, gave altogether the highest ratings the Polish humanities, whose level of development was evaluated as only slightly lower than in the country of current residence of the respondents (average score of 2.6). The lowest average scores were given by the representatives of the economic and social sciences (1.9) and of chemistry and biology, as well as medicine (2.0 each).

The evaluations of the level of development of Polish science reveal certain dependence upon the country of current residence, as shown in Table 4.12.

Table 4.11.

Average evaluations of the development levels of the respective disciplines of science in Poland against the background of the level of development of these disciplines in the country of residence of the respondents

Discplines of science	Average scores
Chemistry and biology	2.0
Economic and social sciences	1.9
Mathematical and physical sciences	2.3
Humanistic sciences	2.6
Technical sciences	2.2
Medical and natural sciences	2.0
Other sciences	1.8

Thus, the emigrants living in Europe and in North America perceive Polish science in a somewhat different manner. The latter assess the state of Polish science in a more critical way. Among the remaining emigrants the relatively most positive evaluation of Polish science is formulated by persons living now in France (average score of 2.3), and also in other countries of Western Europe (2.1). Similarly, persons residing now in Africa or Asia evaluate Polish science relatively well (the same average score of 2.1).

Table 4.12.

Average evaluations of the level of development of Polish science against the background of development level of science in the country of residence of the respondents

Country of residence of the respondent	Average score	No. of respondents
Asia, Africa, Australia	2.1	6
France	2.3	13
Other Western European countries	2.1	26
Canada	1.8	10
United States	1.9	24
Other countries	2.8	9

Generally speaking the average level of Polish science was assessed as slightly lower than the one existing in the countries of current employment of the survey respondents. It must be remembered, though, that the respective evaluations are the outcome of the comparison between the condition of science in Poland and in the countries playing the leading role in world science. Against the background of the comparison between Polish economy and the economy of the most developed countries the analogous comparison of the levels of development of science looks far more advantageously for Poland.

The most important weakness of Polish science lies in organization of work in general and of scientific inquiry in particular. The most pronounced virtue is constituted by the interpersonal relations and the collaboration in the research teams.

A vast majority of scientists who migrate abroad take an obvious professional advantage of this move in terms of a much better equipment of the workplace. An exception is constituted by the opinion of the Polish representatives of the humanities, whose professional situation is in many cases more advantageous in Poland.

Summing up, we can say that the average level of Polish science is in the eyes of the respondents of our survey somewhat lower than in the countries of their new residence, and the highest appraisal among the scientific disciplines in Poland is given the humanities.

4.4. Contacts with the home country and the return option

Persons having emigrated from Poland are strongly linked with Poland and with its scientific community, this fact finding reflection in the declaration of 93% of the respondents that they maintain contacts with Polish science.

Table 4.13.

Forms of contact with Polish scientific community declared by the scientists having emigrated from Poland, in %

Forms of contacts	Yes	No	Lack of data
Tracking the scientific literature at home	54	38	8
Publishing in Polish scientific publications	49	43	8
Participation in conferences and/or giving lectures in Poland	74	20	6
Visiting Polish scientific institutions	80	13	7
Inviting colleagues from Poland to visit own scientific institution	63	29	8

The most frequent form of contacts of emigrants with the Polish scientific community is constituted by the occasional visits in Polish research institutions—80% of respondents undertake this type of contact. Only marginally less frequent is the participation in scientific conferences or lecturing in Poland (74% of the responding scientists declare maintaining contacts in this manner). An important share of respondents—63% of them—invite their colleagues from Poland to their scientific institution abroad. The latter opinion seems to negate the common conviction that

Poles do not help each other. Relatively less frequent is reading of Polish scientific literature (54%) and yet less—publishing in this literature (49%).

Such opinions should be assessed very positively, insofar as due to such frequent contacts, constituting for the Polish scientists a kind of a bridge linking them with world science, foreign migrations of Polish scholars may not altogether lead to a loss, but rather an advantage for Polish science. In the earlier fragments of this report we wrote of the "brain gain" and of the methods for implementation of such policies in the Republic of Korea. Let us now look at the potential our country has for attracting highly skilled specialists.

According to the declarations expressed in the questionnaire filled out by the respondents three quarters of them somehow considered the alternative of returning to Poland, but these were purely theoretical considerations, which have not, as yet, resulted in the actual decision on returning.

Table 4.14.

What difficulties are connected with the potential return to Poland, in %

Difficulties	Important	Little important	Lack of answer
Low salaries of scientists in Poland	53	11	36
Lack of possibility for conducting research on the previous level	38	21	41
Lack of political stabilization in Poland	21	36	43
Worse conditions of learning for children and of work for the spouse	34	25	41
Being accustomed to the current residence location	35	28	37

The greatest obstacle to the return to Poland of the scientists having emigrated is definitely constituted by the low salaries of their counterparts in Poland. This barrier, treated as "important", is quoted by 53% of respondents. The second rank, with significantly lower percentage of responses (38%) is taken by the impossibility of conducting the research on the same high level in Poland as in the current place of employment. Then, only slightly less significant seem to be two kinds of obstacles, namely the difficulty in finding the adequate job for the spouse and the school for children, and the fact of being accustomed to the current location of residence (some 34% each). On the other hand, emigrants perceive Poland as a rather politically stable country, since only 21% of them deemed lack of political stability to be an important obstacle to their return to their country of origin. The information presented here indicates that the possibilities for conducting an active "brain-gain" policy are as of now quite significantly limited.

CONCLUSIONS

The study conducted, and reported here, concerned the mobility of the scientists and the regional image of the Polish university sector, as set against the background of the general situation of Polish science. This study analysed also the fate of Polish scientists who emigrated from the country in various periods. Side by side with the conclusions from the research carried out we will try now to present some reflections which do not result directly from the analysis of the empirical material gathered, but rather from the experience of several years of participating observation in the scientific community.

The study shows that in the years 1994–1996 the mobility of persons employed in science in Poland decreased, both in terms of foreign migrations and of the changes of jobs within the country. This stabilization of the staff, though, is accompanied by the phenomenon of multiple jobs. And so, in the breakdown into scientific disciplines we observe that employment on more than one job concerns almost every second economist and every fourth representative of the legal, social, humanistic and medical sciences. This phenomenon takes smaller dimensions only in natural, technical and agricultural sciences. The main factor stabilizing the staff in the universities is the existence of the private university sector, providing the possibility of additional earnings, frequently much higher than those acquired in the home institution.

The necessary modernization of the country, associated, in particular, with the process of integration with the European Union, will require of the central administration to disburse a much larger fraction of the GDP for satisfaction of the needs related to the public higher education and for the development of science. Higher schools will not be able to increase further their numbers of students in view of the shortage of premises, equipment and teaching staff. Thus, in order to be able to attain the average values of the higher education indicators corresponding to the European levels and

to improve the quality of university education the following undertakings have to be made:

- Construction of new premises for public higher schools, along with the improvement of the technical and laboratory equipment, computer networks and libraries.
- Curbing the outflow of academic teachers from public schools through improvement in their working and financial conditions.
- Reorganizing the study structure through introduction of the three cycles of teaching: the three-year fundamental cycle (licentiate), followed by the two-year complementing cycle (master's), and, whenever the number and the quality of staff allow, the permanent three-year doctoral studies preparing for work at the universities and in research. The latter undertaking is especially important in view of the acute shortages of the staff and the generation gap existing in numerous disciplines of science.
- Reshaping the university teaching by liquidation of the stiff division into the academic disciplines and introduction of the possibility of studying at various faculties under the condition of having a certain minimum curriculum credited.
- Creation of the financial incentives for the research staff of the institutes belonging to the Polish Academy of Sciences to establish, on a much larger scale than until now, the doctoral studies and to get involved in the teaching at the universities.
- Limitation of the right to confer the titles of doctor and doctor of science, aiming at concentration of these rights at the universities of the highest scientific level. The juries conducting appropriate examinations should be composed of the scholars working at the universities different from the one of the candidate. A possibly wide use should also be made of foreign referees, making it possible to gradually enter the programs of European doctorates.
- Creation of incentives (higher wages, service apartments) in the smaller centers for the employees living and working in the larger ceters, in order to attract them to take up temporary jobs, lasting several years, in the provincial centers of higher education [1].
- Support for the regional initiatives in the domain of expansion of university education, with due care taken, though, that the rank of the local schools not be artificially raised by the granting of the university status, since this often leads to a lowered education level. Cases are known

[1] Such incentives are being applied, for instance, by the governor of Zielona Góra province, who wants to strengthen the local university center.

where the merger of two good higher schools of a professional profile ended up with appearance of a bad university. An exception may perhaps be provided in the nearest years by the branch of the University of Warsaw located in Białystok, which, after having coalesced with the local Medical Academy, will have the opportunity of transforming itself into the self-standing regional University of Podlasie.

- Establishment of the new three-year higher professional schools, planned for the coming years, should be preceded by the analysis of the capacities represented by the staff available in particular localities[2]. Care should be taken, on the one hand, that the new schools do not "drain" the already existing schools of their employees, and, on the other hand—that the staff of low qualities does not get employed in such professional higher schools (this reservation usually applying to the teachers from the secondary technical high schools). The analysis of the staff available in individual centers indicates that the higher professional schools could be located in all the centers of the Ist IInd order of magnitude, and also in Białystok, Rzeszów, Bydgoszcz, Olsztyn, Opole, Słupsk and Siedlce.
- The branches of the technical, economic and the like university-type higher schools should be transformed into the higher professional schools, since they only apparently, due to the name of the parent university, satisfy the standards of the university type school. An instance of such a situation is provided by the branch of the Academy of Economics in Wrocław, located in Jelenia Góra, where there are 30 students per 1 academic teacher[3].
- The spatial setting of the higher schools should be based upon the strongest centers: Warsaw, Cracow, Katowice (the Upper Silesian agglomeration), Poznań, Wrocław, Lublin and Łódź. These centers, in which 84% of scientific titles were conferred, are almost exclusively responsible for the reproduction of the research and teaching staff in Poland. The higher schools of these towns group the greatest number of scientists of the highest level. That is why they should obtain much bigger means for the conduct of scientific research.
- Financial support should be extended to these higher schools which undertake the initiatives of establishment of the innovation networks,

[2]Graduation from such a higher professional school should not close the door to acquisition of further education at a proper university.

[3]Similar conclusion applies to the branches of technical universities in Płock, Elbląg, Bielsko-Biała, Wałbrzych and Legnica, to the branch of the Sielsian University in Cieszyn, and to some other schools.

technological parks, business incubators, as well as education for the needs of regional development.

- On the basis of the assessment of the capacities of the staff, of the level of scientific dissertations and of the teaching itself, ranking of higher schools should be put together, which, side by side with the numbers of students and of the scientific staff with at least doctor's degree should become the criterion for determining the subsidies granted from public means.