

BRAIN DRAIN FROM CENTRAL AND EASTERN EUROPE

**A study undertaken on scientific
and technical staff
in ten countries of
Central and Eastern Europe**

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Migration - Europe's Integration and the Labour Force Brain Drain

When communism collapsed many feared that the resulting 'brain drain' would both cripple the economies of the countries of Central and Eastern Europe, and finally result in a flow of scientific and technical expertise into undesirable weapon development.

A collaborative survey carried out in ten Central and Eastern European (CEE) countries, however, has revealed that the brain drain was much less serious than once feared. It also shows that the EU programmes supporting science in Central and Eastern Europe have the potential to contribute towards greater stability and to encourage scientists to remain in their home institutes.

Social scientists recognized the need to help the former communist states through their inevitable period of transition and instability. As an initial step, the BRAIN-DRAIN project was set up to monitor and analyze the movement of scientific staff in and from ten former communist countries. Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

The objectives were

- to study the loss of academic staff from academies of science, universities and research institutes;

- to distinguish between academic groups which were more or less inclined to migrate according to professional areas of interest, age, ethnic background, level of qualification; and

- to collect information about working conditions and other motivations for leaving or staying.

The project was financed by the European Commission and carried out within the framework of COST.

The present publication contains a synthesis report on the studies carried out in the different countries as well as summary reports from the countries which participated in the project. Though the reports are different in size and structure, they still give a valuable overview on the situation of emigration and brain drain after the political and economic changes in Central and Eastern Europe.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN

SYNTHESIS REPORT**

The purpose of this report is to summarize the data concerning migration of scientists from ten transition countries. The report focuses on the individual characteristics of each country as well as on some of the general tendencies for the region as a whole.

Chapter 1 METHODOLOGY

1. The project was carried out by research teams from the following transition countries: Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia. Initially, Albania was included in the project, but the project coordinator left Albania and the contract could not start. Many difficulties were encountered in carrying out an international cross-country analysis on migration issues.

Although the countries included had quite similar backgrounds during the socialist period, they are now different. Migration as a phenomenon has a different economic, historical, cultural and ethnic background in each of those countries. In addition, the researchers involved in the project had varying scientific backgrounds: sociologists, geographers, economists, etc. Therefore, a common research approach and methodology was quite difficult to achieve. The other difficulty of the project was due to the fact that some of the contractors were given different tasks according to their technical expertise. The difficulties were increased by the fact that, in some countries, more than one institute was involved in the project. Fortunately, all these complications were overcome, thanks to the efforts and good will of all participants.

2. The main objective of the study was not to develop new concepts or to re-examine the theory of '**brain drain**' but rather to evaluate the process and to analyze the results. The main objectives were:

- Study the loss of academic staff from academies of science, universities and research institutes;
- Distinguish between academic groups which are more or less inclined to emigrate according to professional areas of interest, age, ethnic background, level of qualification, and to collect information about working conditions and other reasons for leaving or staying.

As a first step, the changes within the scientific communities of each country were described. The second step was to evaluate the loss of scientific personnel; _ losses not only due to emigration, but also including scientists who merged into the private sector, got fellowships, or became unemployed.

3. The teams were given freedom within the following methodological framework:

- Common basic terms were elaborated.

The project was based on the UN definition of migration. **'Emigration'** accounts for 'any residing of a local person in another non-resident country for a period longer than one year'¹. Part of the intellectual emigration is external migration of scientists. In terms of the project the category of **'scientists'** included persons with higher education, employed in all sorts of scientific institutions: higher educational establishments, institutes of academies of science, state-financed institutes, company financed institutes, profit and non-profit research institutions. It has been assumed that people professionally engaged in scientific activities are the main group susceptible to brain flow.

Not all emigration of scientists is **'brain drain'**. Only cases in which emigration is connected with the continuation of scientific activities and research is considered as such. Many scientists have left their countries with the help of more liberal passport regulations in order to find better jobs, although not necessarily within the science field. This kind of movement in most cases can be characterized as a waste of scientific potential, or **'brain waste'**.

The active science restructuring, together with accelerating internal and external migration flows, led to a new categorization of these flows. New concepts were introduced, and assumptions were verified with regard to the internal movement of scientists in two main areas: a) **Internal brain drain** which is the lasting abandoning of science for the purpose of moving to private business or performing activities in any other area where scientific experience is being used; and b) **Internal brain waste**. The international exchange of scholars, or **brain exchange**, has been studied separately, and is considered to include the variety of forms of short-term external migration (less than 1 year), work on joint scientific projects, part-time employment abroad, studies abroad, etc.

- Common questionnaires and codebooks were used.

- * Questionnaire 1 was used for the potential migration survey (researchers working in research institutes at the time of the survey were interviewed with this questionnaire).

- * Questionnaire 2 was used for the real migration survey (the heads of personnel departments filled in questionnaires for every scientist who had left their institute during the period 1989-1995, except for natural reasons -retirement, illness, death).

- * Questionnaire 3 was used to investigate the assessment of the management of research institutes of the process of migration (directors/deans of research institutes were interviewed).

The 14 research teams were given the opportunity to include some additional questions to the common questionnaires, showing their particular interests.

- Common principles for sampling were used.

The main task of the project was to assess the loss of academic and research staff. In order to fulfill this task the real migration survey was carried out by the directors of personnel departments. This survey was rather difficult for the

following reasons:

- In most countries access to the personal records of the employees was limited.
- Some heads of personnel departments were newly appointed and did not know why the scientists left.
- Heads of the personnel departments did not know what happened to scientists who changed their positions several times.
- Some heads of personnel departments refused to cooperate.

Because of these problems, the principles of sampling were changed and each country followed a different approach. For example, Poland used a random sample; in Bulgaria all scientists who left the institutes were included in the survey, and in the Baltic countries a very low return rate was realized. These differences in sampling made cross-country' comparisons methodologically unacceptable.

The sample for the potential migration survey included only employees directly involved in research. Three groups of research institutes were included in the sample: Academies of Science, universities, research institutes owned by companies, NGOs and private establishments. Three main research areas were involved in the sample: natural sciences, technical-engineering and social sciences. This distribution helped to identify different patterns of migration according to different type of research institutes and scientific domains. All countries followed the recommendation to carry out the real and potential migration surveys in the same institutes. The method of sampling was a combination of quota and random sampling. Differences among variables were measured in most of the countries by Chi-square (Person) test and Gamma coefficient.

The Directors (deans) of the same research establishments were interviewed. The questions related to brain drain issues, scientific exchange and the effect of all these on the development of the research institute. This survey provided important data on migration issues. A lot of non-standardized information was obtained and analyzed.

A common structure of the final reports was recommended to all project teams.

- Common data processing methods were used. All data was integrated into one file for all the countries, in which real and potential brain drain surveys were organized. Comparative files were then prepared by the coordinator, in spite of the enormous difficulties encountered.

4. Although the research projects were based on the same structure, the reports became rather different. Each of them gives priority to different topics. We cannot conclude which approach is dominating - in some papers it was the demographical approach, in others a sociological or macro-economic approach. The process was as diverse as it is in reality. This is another substantial theoretical result of the project.

5. Only in Poland brain drain has been extensively studied previously. This is due to the fact that Poland experienced mass emigration of scientists already before the beginning of the reforms. The project contributed to the development of concepts on brain drain as well as to understanding this very specific historical period for science and society in general.

6. One of the most important results of the project was the huge amount of information which was collected. This information was difficult to be put in the countries' final reports. We do hope that this information will be further used for in-depth analyses on more specific aspects of the brain drain issue.

7. Most of the participating countries had deficits in financing the project. However, the project teams succeeded to find alternative sources in order to carry out the survey.

8. All teams were asked to develop and suggest hypotheses, but only two countries met this request. The co-ordinator gave each team the opportunity to test their own hypothesis. At the same time the following general hypotheses were supposed to be tested:

How did the macroeconomic situation in different countries influence the brain drain process?

It was assumed that the countries with a higher standard of living and a better economic and social situation as well as with stable and favourable conditions in science would have less migration (both real and potential) problems. That is why a statistical analysis was carried out. The cross-country comparison was a very important opportunity for the teams.

Is brain drain a natural result of opening up borders and science in post socialist societies, or is it mainly due to the difficulties connected with the transition?

The inclusion of Slovenia in the project provided an additional opportunity to verify this hypothesis. Slovenia had opened borders already before the transition. However, Slovenia experienced a real wave of brain drain only at the beginning of transition. This means that the deep economic and social transformation from planned to market economy contributes to the emigration of scientists. The difficulties linked to reforming the society and science increase the readiness to emigrate.

Are the countries different in their real and potential migration patterns?

It was expected that brain drain might have some common features in post-socialists countries, but increased differences became apparent.

Is brain drain still a problem in post-socialists countries or is the mass

emigration of scientists due to active scientific co-operation?

The brain drain process, typical for the beginning of the reforms, has now been replaced by an intensive research exchange in the form of fellowships, joint research projects, short-term visits, part-time jobs, etc.

The survey did not confirm the hypothesis that brain drain is mainly seen as negative for the research institutes. Assessment of the process was more positive than expected, in all countries under investigation.

The survey did not confirm the hypothesis that substantial brain waste occurred during the transition. The survey showed that scientists who left for abroad had a higher research profile, more experience and better achievements.

As to the reasons for emigration, low salaries, lack of stability, lack of appropriate research infrastructure etc., were the main factors behind both potential and real migration of scientists. The acceptance of researchers by the receiving countries is considered the other major factor. The present survey did not discredit the widely spread theoretical concept that the causes of brain drain are motivational and permissive (Watanabe, 1969, p.419). The permissive factors are definitely connected to the capacity and willingness of the receiving countries to admit immigrants in the particular sphere of science.

Chapter 2 BACKGROUND OF BRAIN DRAIN (STATISTICAL ANALYSIS)

1. The demographic situation in all countries in transition is similar. Low birth rates, negative natural growth and an ageing population make the system reacting more sensitively to any loss of population, including migration. The ageing of the population is a major negative factor for the development of the post-socialist science sector.
2. The economic situation varies between the countries. The economic indicators such as GDP growth, inflation rate, and unemployment rate are rather favourable in the Czech Republic, Slovenia, Poland and Hungary. The other countries in transition still have to achieve economic stability and economic growth. In spite of that, the figures for 1995 indicate that most of the countries experience economic growth and the economic crisis seem to have been overcome. This is an important factor for decreasing the emigration trends.
3. Brain drain is a part of the mass emigration which followed the beginning of the transition in all countries, regardless of the pre-reform migration situation. The main problem in studying the migration situation is poor statistics on migration. The data used in the statistical part of the survey provided information on the registered official migration. Not one team could provide even estimates on the actual emigration.

Moreover, there are few data on the break-down of the entire outflow by education, profession, etc.

4. The data confirm that the emigration from transition countries has decreased after the first wave of emigration. This is partly due to the decline of ethnic movements which took place at the beginning of the reforms and which formed the main migration flow from Central and Eastern European countries.

5. Emigrants from the observed countries have higher educational degrees compared to emigrants from other countries, although the statistical data provided by the different countries illustrated that in some of them (Bulgaria, the Czech Republic) highly educated people are less inclined to emigrate than people with lower educational degrees.

6. In the Baltic republics the migration situation is very specific. Before the reforms they experienced incoming migration (including intellectuals) from other countries including the former USSR. Due to the intensive emigration from other USSR countries, the Baltic countries became multiethnic. It is therefore appropriate to divide migration flow from the Baltic countries into two different movements : one to the East and one to the West. The outflow to the East concerns a large, well-educated part of the population. The large inflow of migrants from other USSR Republics before the reforms was an important reason for the large outflow after becoming independent. (In Latvia 111 of the population left for their motherland, in Lithuania about 35 000 left during 1990-1994.) Emigration from the Baltic countries to the West is not large. It is assessed at only 10% of the entire outflow from Latvia. Estonian emigration to the West is not high either, and it mainly concerns less-educated people. The emigration from Lithuania to the West is small as well.

7. In some countries the emigration of scientists started before the reforms. Emigration from Poland is estimated at 1.073 to 1.317 million between 1980-1989. People with high educational degrees constitute 13.3% of the entire outflow from Poland. In the Czech Republic and Slovakia emigration was high when they were still one socialist country. In particular, after the Prague Spring a large number of intellectuals left the country. Brain drain in its precise sense started even before the reforms when some scientists managed to get through the iron curtain.

8. One of the most important emigration trends in Central and Eastern European countries is short-term migration. This is true for migration of scientists, too. Emigrants from the cities prevailed, this led to a decrease of the urban population.

9. Before studying the brain drain phenomenon, a realistic assessment on the development and successes of science in Central and Eastern European countries was to be done. To what extent did the pre-reform science sector have valuable, internationally recognized achievements? Few countries (Bulgaria and Romania) tried to answer this question. They used the following indicators: invention patents, publications, citations etc.

10. All transition countries' science sectors underwent and still undergo deep restructuring. One of its aims is to overcome international isolation, to overcome the narrow profile (for some of the countries) and to solve a problem which is common to all post-socialist countries : the science sector being overstaffed. The simple reduction of personnel was a logical reaction to this problem, but in most of the cases this led to a decreased share of scientists in society.

Shrinking personnel in science (1985 -1993)¹

Bulgaria	54.6
Czech R.	70.2
Slovenia	3.8
Poland	13.2
Latvia	35.5
Estonia	34.6

11. Baltic countries were put in a very difficult situation since a substantial part of science was organised and financed through the centralised USSR budget. After the restoration of these countries, they were supposed to build up their own independent science sectors. Budget constraints were a serious impediment towards this process. The Estonian paper indicates that in some cases the former integration between the domestic and Russian branch research institutes was transformed into commercial joint ventures.

12. Although some countries' economies recovered, this did not automatically bring about improvements for science and scientists. They continued to be in a situation with a small budget, limited resources for research and equipment, and low salaries.

¹ *Yearbook of Statistics. Sofia 1994.*

Monthly average wage of scientists by countries (in \$ Us)* 1993

Bulgaria	92.5
Czech R.	259.1
Slovakia	186.2
Slovenia	498
Latvia	52.1
Lithuania	39
Estonia	77
Romania	62

** calculation based on the average dollar rate for the respective year*

In most of the countries the intellectual elite, including the researchers, still face a bad financial situation. Poor conditions in the scientific sector are not only a very strong emigration-generating factor, but also have a negative impact on overall reforms.

13. Substantial reductions of the budget spent on science were experienced in all countries. Now the share of funds for science from the state budget is less than it is in the West, while it was higher before the reforms. In Bulgaria in 1986 17% of the state budget was spent on science; in 1993 it was only 6.6%. In Slovenia the percentage dropped from 6.5% in 1989 to 3.2% in 1993, and in Romania from 3.4% to 1.3%.

14. Due to the reduction of the state budgets for science, research personnel decreased dramatically. The loss of scientists for the period 1990-1994 is assessed to be 60% in Latvia; in Bulgaria it is 54.6%, in Estonia 34.6%, in the Czech Republic 70.2%, in Poland 13.2%, and in Slovenia 3.8%. The statistical analysis proved that there is no significant relation between the reduction of personnel and the scope of emigration. The absorption capacity of the local labour market plays an important role.

All countries emphasized that any further reduction of scientific personnel would be a threat to the existence of science.

15. After having overestimated science for many years, now most of the countries in Central and Eastern Europe underestimate this sector. The number of employees in the science sector per 1 000 of the population is 11 in Bulgaria, 13 in The Czech Republic, 7 in Slovenia, 2 in Romania, 9 in Estonia, 3 in Poland, 2 in Latvia.

Employees in the science sector (per 1000 population)

Bulgaria	11
Czech R.	13
Slovakia	7
Slovenia	7
Poland	3
Latvia	2
Romania	2

16. In most of the countries the academies of sciences and the state research institutes were mainly affected by the reduction of personnel (Poland, the Czech Republic, Slovakia, Bulgaria, Lithuania). Staff in universities was not affected substantially by these reductions. Technical and engineering sciences suffered most from loss of staff: Latvia 86.6%, Bulgaria 40.0%, Estonia 67.5%, Poland 24.1%.

17. Due to the reduction of research personnel, the average staff number decreased in every institute. Big research institutions were replaced by smaller, but more flexible and autonomous research units.

18. Salaries in the science sector in most of the countries are low and even lower than the average salary for the country (Poland, Bulgaria, Romania, Slovakia, Estonia, Latvia). Slovenian scientists receive the highest wage - \$498, the Czechs \$259.1; and scientists have the lowest salary in Lithuania with \$39 (1993). Evidently the wage gap between the East and the West creates a high incentive for emigration.

19. Most of the countries indicated the important role of a second job for the researchers' income. They do have additional jobs and survive on them. For example in Latvia 75% of the scientists have a second job. In Poland and Bulgaria university professors have more than one job more frequently than R&D researchers. All team members judged this phenomenon to be negative for research results and scientific professionalism.

20. Some of the countries reported new and flexible forms of funding science such as the establishment of special governmental funding schemes with private contributions. The private sector is still too weak to play an important role in financing the science sector. In Estonia, for example 7% of its science is financed from external sources and in Lithuania it is 1.1%.

21. The lack of generation replacement is one of the most serious problems identified by all researchers. The age of scientific personnel is increasing and unfavourable conditions in the science sector do not attract young people.

22. Another problem is the slow development of the private education sector in the countries of Central and Eastern Europe. The non-governmental sector is increasing in science, but very slowly. In Latvia, Lithuania and some other countries there are no private universities and research institutes at all.

23. The survey showed that the socialist countries integrated science into the COMECON and the Russian science empire. Now research contacts and projects within these networks have been interrupted. National science sectors, like the economic and political systems, are searching for a better identity, independence, and integration into the European Union.

24. The number of students is an interesting factor for the development of the scientific potential. In 1991-1992 the number of students per thousand of the population was 17.1 for Latvia and 15.9 for Lithuania. These numbers were a little higher for Estonia. In Bulgaria the corresponding number was 11.3 in 1985 and 19.2 in 1993, in the Czech Republic the numbers were 10.6 in 1985 and 11.1 in 1993, in Romania 7.0 in 1985 and 10.3 in 1992, in Poland 7.6 in 1985. Compared to OECD countries, the number of students there was much higher: in 1988-89 in Austria 25, in Belgium 26, in Denmark 24, in Finland 28, in the Netherlands 29, in Norway 26. It means that the potential for the future development of science is decreasing in all Central and Eastern European countries. The share of the population with higher educational degrees is quite low in some of them (Romania 15.4% in 1992).

Number of students (per 1000 population)

Bulgaria	19.2
Czech R.	11.1
Slovakia	10.0
Slovenia	12.0
Estonia	16.0
Poland	7.6
Latvia	17.1
Lithuania	15.9
Romania	15.4

25. Unemployment among university graduates is rather high in Bulgaria (17%) and Poland (52%).

26. The problems encountered in science have a negative effect on all spheres of life: the economy, culture, and society in each of the countries under investigation.

The restructuring of the society, and in particular of science, resulted in dynamic movements of personnel, with regard to external, internal, demographical and professional aspects. This dynamic is difficult to capture, but the teams tried to do so - to get the dynamic picture of the past and to look to the future.

Chapter 3 REAL MIGRATION OF SCIENTISTS

Real External Migration of Scientists

1. The survey on the real migration of scientists indicated that all countries included in the project experienced large emigration waves after the reforms started. It was a process linked to the opening of state borders which followed the general migration wave. Now, decreasing migration is also followed by decreasing migration of scientists. The study provided evidence that the main outflow of scientists occurred together with the mass emigration wave. The reasons for intellectual migration were similar to those of the general migration. But, emigration of scientists was characterized in the survey as a specific process influenced by some additional factors and having specific features.

2. It was already mentioned that the survey on real migration encountered serious methodological problems. The scope and representative ness of the real migration surveys vary between the countries.

Scientists emigrated

(% of the total of those who left the science sector during 1989-1995)

Bulgaria	11.5
Czech R.	4.0
Slovakia	11.3
Slovenia	1.7
Estonia	13.8
Poland	15.0
Latvia	3.6
Lithuania	n.d.
Romania	3.0

The teams assessed the brain drain process as follows:

Latvia. In Latvia the real migration survey covered 702 persons, 7.5% of

the research losses over the past 5 years. The real brain drain is estimated at 3.6% of the outflow from research institutes. Out of the scientists who left Latvia for abroad, 3/4 are researchers working in science. 150 to 250 scientists or 3.8% of all emigrants had left the country by the end of 1994.

The Czech Republic. Out of the 359 researchers in scientific institutes only 4% emigrated. 80% of them left in order to continue their research work.

Slovakia. 939 scientists who left the research institutes between 1989 - 1995 were included in the real migration survey. Most of them worked in natural sciences (48%). For 20% of them, heads of personnel department could not give any information. The sample does not allow to provide figures. However, according to the obtained data, 11.3% out of the total outflow from science left the country.

Bulgaria. 11.5% of the outflow from science during 1989-1995 emigrated abroad, and more than 87% of those scientists worked in research.

Poland. Between 1988 and 1994 emigrants accounted for 15% of all scientists who left the research institutes. Available information shows that 68.7% of them continued research. Despite the fact that Poland experienced a large brain drain before 1989 and the fact that the emigration of scientists decreased, the survey proved that Poland is the country with the highest proportion of scientists who left for a research job for more than one year.

Estonia. 13.85% of those who left the institutes emigrated abroad. Available information indicates that 65% of them went into the science sector of the receiving country.

Lithuania. The largest number of researchers departed from those institutions which in the Soviet period were deeply integrated into the economic and military structures of the Soviet Union.

Romania. The total decrease of the personnel was 20% in the institutes covered by the study. The emigration of scientists concentrated on few institutes. Emigration represents 3% of the total outflow from science. The highest decrease was observed with regard to auxiliary staff. 74% of the total outflow was assessed as brain drain.

Slovenia. Slovenia had the smallest emigration rate at the beginning of the reforms. This was mainly due to the openness of Slovenian borders before the reforms and to the easier transition to a market economy. Real brain drain is estimated to amount to 1.7% of employed scientists.

3. The data indicate that the outflow of scientists really can be regarded as brain drain since less than 10% of the scientists, who left the countries, do not have a job in science. (It should be taken into account that this figure includes the scientists for which heads of personnel departments have no information).

4. Professional features of researchers who have emigrated are the same for all countries. They are top scientists from Central and Eastern European countries. All countries emphasized the high profile of those who left. Doctors of sciences are prevailing among the emigrants. In all countries the majority of the scientists who emigrated had had fellowships abroad or frequent research contacts with the receiving institute. Only in the case of Romania emigrants had higher positions in the administrative sector of science. In the other countries real emigrants did not occupy managerial positions in science. The demographic features of real migrants are favorable as well. These are

young scientists. In all countries the age of real migrants is mainly between 30 and 40.

5. The survey proved the hypothesis that different types of research institutions have shown different patterns of emigration. Brain drain in Poland, Slovakia, Estonia and Bulgaria was mainly experienced in academies of Science, while in Romania and Slovenia it happened in the universities.

6. Surprisingly the destinations of emigrating scientists are similar for all countries. A parallel can be drawn with the brain drain process from Western Europe to USA in the sixties and the brain drain from Central and Eastern European countries to the USA after 1988. Acceptance by the receiving country is a very important factor for channeling emigration. The USA appears to be country most open for scientists from transition countries (More than 50% of Poland's scientists emigrated to the US.) The countries of the European Union are placed second as receiving countries. The choice of destinations has historical, cultural and geographical reasons.

Destinations of brain drain

Bulgaria	USA 28%,Germany16%, Canada 9.9%
Czech R.	USA, Germany, Canada
Slovakia	Czech R. 23.8%, USA 20.8%,Germany 7.5%
Slovenia	USA 40%, EU 34%, Canada 10%
Estonia	Scandinavian C. 45% USA20.9%,Germany13
Poland	USA 50%,Germany, France
Latvia	USA and Canada 28.9%, Israel 26.4%
Romania	Germany 27% USA 15%,France 12%

Bulgaria. The main destinations the scientists emigrated to were: USA 28%, Canada 9.9%, Germany 16.6%, UK 5.7%, the Scandinavian countries 8%.

Estonia . 20.9% emigrated to the USA, 45% to Scandinavian countries, 12.8% to Germany, 7% to Russia (Estonia is the country with the highest emigration to another post-socialist country).

Latvia . The scientists emigrated mainly to the USA and Canada 28.9%, to Israel 26.4%. During the last few years emigration to Europe increased.

The Czech Republic. The main destinations were USA, Canada, and Germany.

Poland. The main destination for Polish scientists were the USA (approximately 50% of the outflow), followed by Germany, France and the UK.

Slovakia -The Slovakian brain drain was directed to the Czech Republic 23.8%, USA 20.8%, Germany 7.5%.

Romania. 27% of the Romanian scientists emigrated to Germany, 15% to the USA and Canada and 12% to France.

Slovenia . 40% of the outflow of scientists was directed towards the USA, 10% towards Canada, 34% towards Western Europe.

7. The emigration of scientists is influenced by complex factors linked to economic transition. Ethnic factors played a role at the beginning of the reforms when the mass wave of emigrants involved a lot of scientists as well (Jews from the Baltic countries to Israel, Russians to Russia, ethnic Turks from Bulgaria to Turkey, ethnic Hungarians from Romania to Hungary; 3% of the Romanian scientists moved to Hungary).

8. The survey explains the mechanisms scientists used for emigration. It is important to stress that in all countries emigration occurred because of invitations and support from the receiving institutes. Only in Romania the most frequent reasons for the emigration of scientists was either family reunification or marriage.

9. One of the unexpected results of the survey is that those science domains which were strongly affected by reduction of the personnel did not have the highest emigration rates. Emigration occurred mainly in those sectors of science having a high profile, recognition and contacts with the international research community.

Brain drain by sectors

Bulgaria	Chemistry, Biology, Medicine, Physics
Slovakia	71% natural, 11% technical, 18% social sciences
Slovenia	58% natural, 20% technical, 22% social sciences
Estonia	cybernetics and medicine
Poland	natural sciences, engineering
Latvia	28% organic synthesis, 8,8% social sciences
Romania	Mathematics and biology.

Latvia. 35% of the scientists in foreign languages emigrated, 8.8% of the scientists in social sciences, and 28% from the field of organic synthesis.

Estonia. The main domains for emigration were medicine and cybernetics.

Poland. The largest emigration was from natural sciences, followed by engineering and technical sciences.

Slovakia. Emigration affected mainly natural sciences (71%); 11% occurred in technical sciences, and 18% in social sciences.

Romania . Mathematicians and biologists experienced the highest emigration rates in Romania. These were those scientific domains which, according to the suggested criteria, were most successful in Romania.

Slovenia. 58% of the emigrants came from the natural sciences, 20% from technical and 22% from social sciences. The highest percentage belonged to medicine followed by chemistry and biology.

Bulgaria. Natural sciences were more developed and involved in international contacts. Therefore it is not surprising that emigration occurred mainly in these domains, and in particular in basic science: chemistry, biology, medicine, physics.

10. In all countries the highest emigration rates were experienced at the beginning of the reforms and it was provoked by a combination of motives: political, ethnic, economic. Now, total emigration and emigration rates of scientists are declining (except for Romania). The decrease is caused by the restrictive immigration policy of the West and a lack of encouraging factors. In the Baltic countries emigration started a bit later than in the other countries, due to a later start of the reforms and a later liberalisation of the passport regime.

11. The regional aspects of the brain drain process were studied in Poland, Romania and the Czech Republic. The data indicate that capitals experienced a higher emigration of scientists than the other parts of the country. This fact could be explained by the fact that capitals have more research information available. They used to have more contacts with foreign institutes, and they are closer to the central administration. Regional disparities in research call for special attention from the Government. The survey also indicated that the emigration process was concentrated on some institutes, while others were not affected by the process.

12. In most of the countries (Slovakia, Poland, Bulgaria, Romania) the survey did not show any significant differences in the shares of male and female emigrants. Only in Slovenia the men account for 70% of the total outflow of researchers. However, this is due to the gender composition of the Slovenian science sector.

13. The survey could not identify any patterns with regard to returning migrants. This means that the positive effects of emigration cannot be assessed yet.

Real Internal Migration of Scientists

14. The study focused mainly on the internal migration of scientists since the majority of them remained in the country after leaving their research institute. Most of the reports revealed that internal migration of scientists is a more significant problem for the countries than external migration. The main directions of internal mobility were investigated and the main areas were defined: the private sector, other research institutes, government administration, unemployment.

15. It was assumed that the private sector played an absorption role for scientists who left research institutes during the reforms. The data vary substantially between the countries. In general, the private sector has absorbed the largest part of the researchers who left the institutes. In the Baltic countries the proportion of those who left the research sector and joined the private sector is very small. In Latvia 10.5% of those who left the field of science went to the private sector, and only 1.9% of them started their own company. In Bulgaria 14.3% of the researchers joined the private sector. In Slovakia this figure is 20.6%; in Romania 42% of the internal outflow went to the private sector and self-employment. This movement can only be considered to be positive in case the private business is connected with the research domain in which the scientist worked before. Unfortunately a large part of the internal move of scientists to the private sector turned out to be a real loss for science.

16. Part of the internal 'brain waste'⁷ is the mass wave of scientists not accepted by the labour market. In Latvia 9.2% of the outflow from research are unemployed. In Bulgaria unemployment was the alternative for 28% of the scientists, in Slovakia 7.8%, in Estonia 4.5% and in Romania 3%.

17. A common trend in all countries is that the social scientists moved mainly to the governmental administration. In Slovakia for example 18.9% of those who left the institutes started working in the public services sector or in public administration.

18. In some countries internal brain waste is not substantial. In the Czech Republic 47% of all persons who left the institutes found a job in another research institute, while in Bulgaria this figure is only 13.8%. In Slovakia 18.6% joined another state or non-governmental research institute. In Romania the internal and external brain waste is estimated to be 70% in social sciences, 73% in natural sciences and 75% in engineering.

19. The country with the largest internal migration is Estonia. 35.6% moved from one research institute to another. In Romania this figure is 21%.

20. Negative results from mass internal brain waste are shown in the reports from all participating countries. The Romanian report emphasised that giving up scientific activity is associated with high level of frustration.

Deans' Opinion on Brain drain

21. There is not enough evidence to conclude that directors are very discouraged by the emigration of scientists. As the Slovakian report says: "The evaluation given by the directors (deans) of the research institutes about the impact of the brain drain is more positive than it was expected to be". Most of the directors expect that the emigrants will return. But as the Slovakian case suggests, 25% of the scientists managed to prolong their contracts abroad.

22. The directors of research establishments considered the emigration of

scientists as a process of a 'brain drain' not as a 'brain waste'.

23. In some countries (Slovakia), directors considered internal brain waste as more negative than external brain drain, not only because of its larger size but also because the latter means a waste for science. In individual life schemes external migration is more positive than internal migration taking into account the financial conditions of work and life. From a qualitative point of view external migration of scientists is seen in a more negative way. As was mentioned by the Slovakian authors, the "cream of the cream" left.

24. In Romania brain drain is seen as a negative process for the country and the research sector. The opinion of the respondents about emigration is quite favourable as far as individuals are concerned, but they express their concerns about the consequences for the institute (shortage of top specialists, decrease of prestige of the institute, interruption of the continuity of the research, etc.). This shows that there are individual, institutional and global aspects of the phenomena of brain drain.

25. It is important to mention that brain drain is not a question of quantity but of real quality impact. The Slovenian team identified only 50 cases of brain drain, but it was emphasised that this is a real loss for a small country.

East-West 'Brain exchange'

26. The so called 'brain exchange'⁷ is seen as an alternative to brain drain, and is based on a rather broad definition. Brain exchange includes:

- trips abroad shorter than 1 year for the purpose of education,
- post graduate courses abroad,
- trips abroad related to work in joint projects,
- part-time employment abroad,
- participation in conferences, seminars, etc.,
- participation and performance of national scientists in a scientific environment abroad, i.e. publications abroad, participation in joint projects, etc. .

Defined like this 'brain exchange' means any form of scientific co-operation with foreign partners.

27. Migration is changing its profile. The number of scientists employed abroad is increasing in all countries especially in Poland, Hungary and the Czech Republic. The survey identified an increasing number of short migration of scientists and frequent research contacts. At the moment of the survey, a substantial part of researchers were abroad, participating in different forms of co-operation: conferences, training, work on joint research projects, etc. While 43% of the Czech scientists were involved in some of the above-mentioned forms of international research co-operation, some others were less involved: Latvia 14.7%, and Romania 5.3%.

28. For most of the countries research co-operation outside the COMECON was not possible in the past. The study proved that the system is open now. Cooperation is more frequent in natural sciences. For all countries the programmes of the EC are the main support, programmes from USA are twice as small. Similar figures apply to research visits. While long-term migration is directed mainly to the USA, brain exchange is more intensive with EU countries.

Scientists working on projects financed by EU and USA (%)

	EU	USA
Poland	30.2	13.4
Hungary	27.6	19.2
Czech R.	39.5	15.9
Latvia	40.4	9.0
Slovenia	59.2	26.0
Estonia	22.5	6.7
Romania	40.1	6.0
Slovakia	36.9	21.4
Lithuania	62.4	12.7
Bulgaria	55.7	17.0

29. The most frequent duration of these visits is up to three months. Research co-operation is not concentrated in countries where emigration took place; European visits and contacts are predominant. The most visited countries are : for Latvia - Germany 21.8%, Sweden 13.4%, USA and Canada 9.2%; for the Czech Republic- Germany, UK, France; for Romania - USA and Canada 22%, France 21%, Germany 13%, UK 9%, Italy 7%; and for Bulgaria - Germany, UK, France.

30. The survey concluded that there are no active research contacts between East European countries. Previous joint research projects and relations are practically non-existent now. The East-West co-operation replaced East-East research integration. Joint research projects are carried out mainly with European countries. The Baltic countries have more research contacts with the Scandinavian countries, and they have some joint research projects with Russia.

31. The survey proved that the most active side in the research exchange with PECO countries are EU institutions and countries. The data for scientists who worked at the moment of the survey on projects, financed by the EU and the USA is the following:

Poland: 30.2% of the projects financed by the EU, 13.4% by the USA.

Hungary: 27.6% financed by the EU, 19.2% by the USA. **Czech**

Republic: 39.5% financed by the EU, 15.9% by the USA **Latvia:**

40.45 financed by the EU, 9.0 by the USA. **Slovenia** 59.2% financed

by the EU, 26% by the USA. **Estonia** 22.5% financed by the EU, 6.7% by the USA. **Romania**: 40.1 % financed by the EU, 6.0 by the USA. **Slovakia**: 36.9% financed by the EU, 21.4% by the USA. **Lithuania**: 62.4% financed by the EU, 12.7% by the USA. **Bulgaria**: 55.7% financed by the EU, 17.0 by the USA.

32. Hungary is more involved in scientific exchange than other countries. 56.3% of the interviewed scientists were involved in joint research projects during the survey, while for Romania this figure is 17.8%, for Lithuania 22.6%, for Bulgaria 23.3%, for Latvia 27.2%. While all countries show similar data for real migration, data for brain exchange vary.

Participation in a joint research project with western institutes

	% of respondents participating research in a joint project
Poland	25.8
Hungary	56.1
Czech R.	43.0
Latvia	27.2
Slovenia	43.2
Estonia	37.6
Romania	17.8
Slovakia	28.4
Lithuania	22.6
Bulgaria	23.3

33. Interviewed scientists' assessment of work in international projects was very positive.

Chapter 4 POTENTIAL MIGRATION OF SCIENTISTS

- The main task of the potential migration survey was to identify whether another wave of brain drain could be expected. Potential migration was studied with regard to :
 - * external migration (short term and long term)
 - * internal mobility.
- Before studying potential migration, the environment for migration was examined. The living standards of the researchers were precisely examined. A comparative analysis was carried out on the main features for all researchers. This part of the study led to the following conclusions :

The ageing of science personnel is one of the most important problems for all countries included in the project.

Although the data showed that scientists have some property such as a house, foreign currency savings, a car, a computer, they pointed out their financial situation was bad. Most of the scientists consider that their financial status became worse since the beginning of the reforms: 63.5% of scientist in Bulgaria, 70.5% in Latvia, 52.8% in Hungary, 56.9% in Romania, 56.1% in Estonia, 30.1% in the Czech Republic and only 21% in Slovenia.

Social differences among scientists are increasing in some of the countries. The majority consider themselves to be part of the middle class (66.7% in Slovenia, 53.2% in Bulgaria, 52.6% in Latvia and 48.6% in Poland). But, except for Slovenia and the Czech Republic, the rest think they belong to the poorest part of society (41.8% in Latvia, 40.6% in Bulgaria, 42% in Poland).

The technical conditions for science in the PECO countries are very different. 72.2% of the Romanian scientists considered that they did not have the equipment necessary for their research, 69.6% of the Lithuanian researchers, 65.3% of the Bulgarians, 63.1 % of the Latvians and 61.1 % of the Estonians. In Hungary 27.1 % of the scientists express the opinion that they do not have the required equipment; Slovenia 28.5%, Poland 33.1%, Slovakia 48.1%.

Academic achievements vary between the countries, research institutes and regions. In general they are quite high. Most of the scientists have publications abroad.

Publications abroad

Country	Share of the scientists without any publications abroad
Poland	41.2
Hungary	21.6
Czech R.	27.8
Latvia	43.1
Slovenia	5.0
Estonia	27.0
Romania	51.4
Slovakia	29.4
Lithuania	22.7
Bulgaria	15.9

The leading country in this respect is Hungary. Only 21.6% of the scientists included in the sample did not publish abroad, while in Romania this figure is 51.4%. The survey

showed that a small proportion of scientists have most of the publications abroad, while the others do not have any. This proves that there are differences in the development of science in different domains, institutes and regions.

Potential External Migration

3. It is logical to assume that the scientists, who were interviewed, expressed a strong desire to leave their countries for more than one year, especially when they receive an offer. Romanian and Bulgarian scientists are more inclined to emigrate than the scientists from the other countries. Scientists from the Baltic countries express very low interest in migration. But the general desire is not a correct indicator for potential migration. That is why the project team used some other indicators to assess potential migration. First, real actions undertaken by the respondents were considered. While Bulgarian and Romanian researchers have the strongest intention to leave, concrete steps in that direction were realized mainly by Hungarian researchers: 6.3% of all respondents. This figure was 4.4% for Czech researchers, 4.4% for Slovak researchers and 3,3% for Slovenians.

4. The second step to assess potential migration among scientists was to divide respondents into 3 main groups with regard to their intention to leave the country.

Group I. **Determined emigrants**. Those who, without any hesitation, would accept at least one proposal in the nearest future to go abroad for a period exceeding one year. The group of respondents who would accept any proposal for a lengthy stay abroad for more than one year, and were in fact already completing the necessary departure papers. Some of the countries have integrated this small group into the group of those respondents who expressed a determined will to emigrate, but had not yet taken any concrete measures for leaving.

Group II. **Undetermined emigrants** The group includes those who would like to emigrate for a period of over a year, but their final decision depends on the concrete conditions and situation.

Group III. **Determined non-migrants** This group includes the respondents, who have given a determined negative response to all proposals to go abroad for a period exceeding one year.

This division was implemented by most of the countries' teams, and led to the assessment of potential migration on a comparative basis.

5. The survey did not provide evidence for a large potential emigration of scientists from Central and Eastern European countries. Determined emigrants represent not more than 3% in all countries.

Determined migrants

Country	% from total number of scientists
Poland	2.1
Hungary	6.3
Czech R.	4.4
Latvia	1.5
Slovenia	3.3
Estonia	1.5
Romania	2.6
Slovakia	3.0
Lithuania	1.0
Bulgaria	2.3

In **Latvia** determined emigrants are estimated at 1.5% of the scientists, mostly from engineering sciences. Another 8% of the scientists have planned to emigrate, but have not undertaken concrete steps, and 6.9% have decided to emigrate after some time. 16.7% are the determined non-migrants.

In **the Czech Republic** 4.4% of the scientists belong to the group of determined emigrants, 9.4% have not undertaken specific steps, 18.2% would like to leave but not now.

In **Poland** determined emigrants amount to 2.1% of all scientists. The probable emigrants constitute 23.8%, non-migrants 74%.

In **Slovakia** scientists who have made plans to emigrate represent 16 % but steps were undertaken only by 3% of them.

In **the Baltic countries** the potential external mobility of scientists is very low, between 1-2% of all researchers interviewed.

In **Romania** determined emigrants amount to only 2.6%. Compared with the high willingness to emigrate, the share of the determined emigrants is very low.

6. While the countries have given very similar assessments with regard to potential determined migrants, big differences appeared when the proportion of determined non-migrants was assessed.

7. The survey showed that the expected potential emigration of scientists could be considered as brain drain since most of the potential emigrants plan to do research in the receiving country. Any kind of work will be accepted by 10.7% of the Lithuanian emigrants, 8.5% of Romanian researchers, and 5.4% of the Bulgarian researchers. Long term training (more than one year) is a less attractive option for emigration. Only 3.1% of potential Hungarian emigrants, 3.5% Bulgarians and 5.2% Slovaks intend to accept training abroad for more

than one year. Only researchers from the Baltic countries are more likely to accept it. It is important to emphasize that the most attractive offer for all countries' respondents is a job at a research institute. Less interesting is to work in a joint research project. The latter means no interruption of the labour contract and relations with the research institute. This is the preferred choice of Hungarian researchers, considered as potential migrants. 33% of them intend to work abroad for more than one year in an international research project.

8. The preferred countries of destination for potential migrants are common for all countries. In contrast to the real migration, for which the main destination was the USA the main direction for potential migration is the European Union. Reasons for selecting a country are linked to better conditions for research. The preferred destinations are:

Bulgaria. 31.3% of the potential migrants want to leave for Germany, 23.9% for the USA, 12.9% for a Scandinavian country, 9.8% for the UK, and 9.2% for Canada.

The Czech Republic. West European countries are preferred by 55.4%, the USA is chosen by 27% and Canada by 9.3%.

Poland. Traditionally, Polish scientists migrate to the USA and 36% of potential migrants would follow this tradition. 19% of potential migrants would like to move to Germany, 11 % to the UK, 11 % to France.

Slovakia. European countries are preferred by most of the Slovakian migrants, the USA only by 12%, Germany by 11.3%, Austria by 5.1%, the UK by 4.7%.

Estonia. The most preferred destination are the Scandinavian countries.

Romania. The main country of destination for Romanian scientists is France with 31.4%, the UK with 10.2%, Germany with 9.8%.

9. Potential migrants undertook some steps to realise their migration intentions. The most frequent step is to look for assistance from institutions and persons abroad. Reading advertisements is another way for collecting information and preparing to leave the home country. Less popular among scientists in Central and Eastern European countries are employment agencies. This segment of the labour market is still not developed in most of the transition countries.

10. One of the main results of the survey is that brain drain is mainly depending on the receiving countries. Questions relating to the financing of the trips showed that more than 70% of the determined migrants have to be financed by the receiving institution.

11. The length of the stay of determined potential migrants is between 1 to 3 years. In Latvia 80.7% of all determined potential migrants want to stay abroad for less than 3 years and only 1% for ever. In the Czech Republic 90.6% would like to stay for up to 3 years and 2.3% for ever. In Poland 90%, in Slovakia

42.4%, in Estonia 80% would like to stay for a period of up to 3 years. In Romania 8.9% of the migrants would like to stay for ever. Bulgarian scientists go for the longest duration of emigration. 42.1 % of the potential determined migrants would like to stay for up to three years, and 11.7% would like to emigrate for ever.

12. The survey proved that the features of determined potential migrants differ from those of the other respondents. They have higher professional qualifications; better knowledge of the language, research degrees, more visits abroad, more publications abroad. They are young, but experienced. The age is a strong factor for the potential migration of scientists. The features of determined potential migrants are close to those of real migrants.

13. The common research strategy provided an opportunity to study the motivation structure of scientists as well as their value structure. Results showed that the motivation of scientists is linked to the contents of their work and their achievements. Certainly, the economic motivation plays an important role in all countries, including those whose living standard is higher but, such indicators as professional satisfaction, research infrastructure play a very important role for the scientists. In all countries priority was given to values orientated to the nature of the research. Professional satisfaction, scientific independence, scientific information etc., those are the main goals of the scientists.

14. There is a substantial difference between the countries in relation to the possibility of achieving the main values in the home country or abroad. In some countries (Bulgaria, Romania, Latvia, Lithuania, Estonia, Slovakia) most of the researchers indicate that they could achieve financial prosperity and professional success abroad rather than in their own country. It means that these countries have a higher potential for migration. It is a signal for policy makers that researchers are frustrated and could look at emigration as an alternative. Therefore there is a large proportion of undetermined migrants in these countries. Their migration behavior will depend on the future development of science in their countries, and their general situation. It means that they could become determined migrants if the situation is deteriorating. The substantial difference between the conditions for research in Central and Eastern European countries and receiving countries is the strongest pro-emigration factor for the determined migrants.

15. The strongest factor preventing migration of scientists is the separation from their families. It was indicated in almost all country reports. The low level of potential external migration is connected above all to factors relating to the ageing of science personnel. The other reason is that those who were capable and desiring to leave, have already emigrated. Part of the frustrated scientists also already moved to other positions.

16. The main conclusion of the survey is that the transition to a market economy and the opening up for international research exchange has reduced the emigration rate of scientists. However, the outflow of relatively young and highly qualified scientist continues. This process is widening the generation gap in science. The problem of emigration is not considered as serious by all teams.

17. Migration is a normal and necessary process. It satisfies the need for intellectual changes and globalization of science. However, the permanent stay of scientists abroad does mean a loss for their home countries.

Internal Potential Mobility of Scientists

18. One of the unexpected results of the study was that potential internal mobility turned out to be smaller than potential external migration. It is surprising that, although the scientists express strong dissatisfaction with the deterioration of the situation in the country, 68.4% of them in Bulgaria, 67% in Lithuania and 62% in Estonia do not want to leave their employer or are looking for another job in their country.

19. The share of scientists who definitely would like to leave research is between 1.4 to 3.4%. The undetermined group is two to three times smaller than the group of the undetermined potential external migrants. External migration is a more desired option for the majority of scientists.

20. All researchers involved in the project stated that the migration situation in science is rather stable. External and internal movements are within the range of normal turnover even in countries with a deteriorating economic situation. However, in these countries stability is fragile, research personnel is still feeling uncertain, and external migration is seen as an alternative. That is not the case for countries more involved in scientific co-operation such as Hungary, the Czech Republic, Poland and Slovenia. Therefore special attention should be given to countries less involved in this co-operation in order to diminish their migration.

Recommendations

21. The project proved that research exchange and co-operation in science is possible. Recommendations vary between the countries, but there are some common problems which require similar steps. Some of the recommendations are directed to national authorities, some to the European Union.

22. Recommendations for the countries in transition ('sending countries' in terms of migration) are:

* Reforms should be intensified, but require a clear strategy. The political

and economic situation should be stabilized. Any further reduction of science personnel would be dangerous.

* Potential mobility (both external and internal) is high in countries and institutes in which the reform does not allow clear lines and which are unsuitable. New institutional structures, new management structures, planning and organization of research is needed. In this area the EU could help with its experience, and with technical assistance to governments and management structures in science.

* Measures such as emigration control, emigration taxes, suppressing information etc. are unrealistic. The emigration of scientists should not and cannot be stopped.

* Governments have to establish reasonable conditions for the development of science and the stabilization of science. A good research infrastructure is needed. Salaries and the standard of living should be improved.

* Governments should take measures to attract young people to science.

* Alternative sources of financing science have to be found; the private and non-governmental science sectors should be promoted.

* Governments should encourage the access of researchers to scientific information networks and opportunities to publish abroad. Improvements in the access to scientific information could help reducing the peripheral scientific status of some countries and regions in Central and Eastern Europe.

* Scientists coming back from abroad should be given opportunities for reintegration in science sector of the transition country. Thus the 'sending country' will profit from the positive side of brain drain, since the migrants have collected rich experience, not only in their particular research area, but also in the organisation and economics of science.

* The Governments of PECO countries should start establishing contacts with emigrated scientists. A special policy towards research emigrants should be developed.

23. Recommendations for receiving countries :

* The study proved that the EU has substantially promoted East-West co-operation in science. First results of this policy were shown by the empirical evidence collected by the survey. Further steps for promoting all forms of co-operation are recommended.

* Special attention should be given to short term migration of scientists.

Joint research projects could play a further important role to decrease scientists' emigration. EU countries should encourage this form of co-operation.

* The EU should support the establishment of basic common concepts, terminology, institutional and legal frameworks in the science sector of transition countries.

* Further studies on the issue of brain drain and, especially on the status and prospects of scientists who have emigrated at the beginning of the reforms, should be supported.

* One of the main obstacles for research exchange is the lack of funds. The other serious problem, especially for some countries (Romania, Bulgaria) is linked to obtaining the necessary visa. About 50% of researchers have missed an opportunity to travel due to visa problems. The visa regime should not be an obstacle for research exchange.

Working on the project was a real challenge for all the teams. Financial support was not sufficient, but all countries managed to find additional local sources and thus complete the study. The researchers themselves were very devoted and enthusiastic while working on the project. Their work was not adequately financed given the large expenses for field work and data processing. The teams consisted of people with different research background - economists, demographers, statisticians, geographers, sociologists who succeeded to establish useful general concepts and to come up with valuable conclusions.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

BULGARIA

Bulgaria is one of the specific cases of science development and brain drain. Comparing with the other Central and Eastern European countries Bulgaria boasts the highest number of students per thousand - which is 24 (Estonia - 12, Slovenia - 20, Poland - 11, the Czech Republic - 11).

Bulgaria is one of the countries with the largest share of unemployed with higher education - 17% of all unemployed. Unemployment promotes emigration tendencies among scientists. Data indicate that the Bulgarian science personnel is ageing. Less and less young people work in research institutions. Special policy measures are needed to encourage young people. Before the reforms, Bulgaria used to have the highest standard using the indicator "employed in science per capita". Now, Bulgaria comes second after the Czech Republic as far as the loss of scientific staff during the transition is concerned. By the end of 1993, the number of scientists had dropped abruptly to 5 per thousand in Central and Eastern European countries. Reductions of personnel have been highest in the field of engineering and agriculture. Social and natural sciences did reduce, but not considerably. In medical sciences employment even increased.

Approximate calculations show that the monthly average wage of scientists in Bulgaria is among the lowest in Central and Eastern Europe. Official statistics show evidence of mass emigration of people with higher education from Bulgaria in the first two years of the reforms. Is there brain drain from Bulgaria? If brain drain is defined as "scientists leaving the country for periods longer than one year with the purpose of a long-term or permanent stay in the other country, where the scientist is professionally engaged in scientific work" such process is observable in Bulgaria. The real brain drain is estimated at about 11.5% of the scientists who left the research institutes. The process is slowing down in terms of numbers of people after 1992, yet a permanent drain of scientists to foreign countries is recognizable.

This process can hardly be expressed in quantitative terms. However, of all scientists who left for abroad, only 13% are not engaged in scientific activities, which means that the emigration of scientists is virtually a brain drain process. Concerning the qualitative characteristics of scientists who left science, those with the most favourable professional and demographic characteristics have gone abroad. The loss of qualified experts therefore is a serious problem for the Bulgarian science sector. Only 11% of emigrated scientist returned. Public perception of brain drain was quite negative. Scientists, deans and directors in science have a different opinion. They see the brain drain process as a period which is over, and also as a kind of "price" which science paid in exchange for its sociability.

The data indicate active scientific exchange at present. While 576 people from 106 institutes have emigrated, 530 are abroad under some kind of scientific exchange. The scientific exchange is oriented mainly towards European countries, while brain drain was directed mainly towards the USA.

The status of Bulgarian scientists still creates an environment favouring high internal and external migration. The relative decrease in potential and real migration, has not yet stabilized scientific personnel. Compared to other countries, Bulgarian scientists are more motivated to leave the country, due to their economic situation which is worse than in the Czech Republic, Slovenia, Poland or Hungary.

Bulgaria should be encouraged to participate in the process of brain exchange. The involvement of Bulgarian scientists in European programmes for scientific exchange should become one of the major instruments for the strategic scientific development of the country.

One of the most unexpected and important results of the study on potential migration of scientists from Central and Eastern Europe is the fact that - according to the major part of these scientists foreign institutions look for scientific products - much more than even the biggest domestic consumer, the state. This holds true for Romania, Hungary, Slovakia and Bulgaria. It can be assumed that this is one of the major reasons for the high potential migration of scientists from these countries, mainly by means of both short-term and long-term scientific exchange programmes. The study confirmed the hypothesis that those countries demanding more scientific results from their scientists, experience a lower potential migration among them.

According to the commonly applied research methodology three groups of potential migrants were identified: determined migrants, undetermined migrants and determined non-migrants. The survey on potential migration of scientists indicated the following tendencies:

- * No significant variations can be observed concerning factors influencing migration intentions in the different countries.

- * The survey did not provide enough evidence of expected mass migration of scientists from Bulgaria. However, as was proved by figures about the real migration of scientists, the most highly qualified scientists want to leave the country for longer than one year. The study also showed that potential migrants will easily decide to emigrate. The potential migration of scientists is not solely conditioned by their economic situation. Essential as these factors can be, research has supplied evidence that dissatisfaction with the role and place of scientists as well as their career opportunities remain important factors in deciding about emigration. The determined migrants are professionally highly qualified, which means that their emigration is a loss for science as well as for society in general.

Research showed considerable differences as to the direction of migration movements between determined and undetermined migrants. 24.5% of the determined migrants intend to emigrate to USA and 14.3% to Germany; from the potential migrants 20% are heading for Germany and 22.9% for the USA. With the determined migrants, England comes third in their preference (13.6% of the sample), and France fourth (10.2%). With

potential emigrants these two countries present similar patterns. Canada is also very attractive as a scientist migration destination.

When evaluating the factors preventing scientists to leave the country, the three groups show considerable differences. Determined migrants regard impediments as unimportant if they have already made up their minds to emigrate. Only 4.6% of the determined migrants have their stay funded by their present institute, 12.2% by other organisations in the country of origin (foundation, etc.), and in 89.9% of the cases by the receiving institute.

Therefore, it can be said that long-term migration is depending on the good will and the financing of the receiving countries.

The data show that almost one fourth of the interviewed scientists participate in a joint research project with Western research institutes. Involving Bulgarian scientists and institutes in joint research projects is a problem. Encouraging Bulgarian scientists to participate in such projects should therefore be a major goal of the management of Bulgarian science. On the other hand that participation depends on the opportunities offered by European integration and international organisations. In this respect additional help from different countries is needed, and new ways for the involvement of Bulgarian scientists in international projects have to be found. Finding the right information on collaboration opportunities is a problem as well. However, good science marketing is not enough for the participation in an international project, it also depends on the personal approach of scientists themselves. Research results show that in some countries financing a research project is an instrument for the increase of the budget of the whole institute, and the personal support, participation and financial benefit for the scientist who has contributed to acquire the project, is quite unsatisfactory. Participation in international projects therefore should be managed properly. Specific mechanisms should be established for these needs.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

Czech Republic

The present state of higher education as well as of research and development in the Czech Republic reflects the existing transformation era. Though some important tasks in the sector in question are still to be fulfilled, the basic transformation steps of installing new organizational structures, new models of their management (respecting the market-driven economic environment) and partly also new systems of work have been implemented. Logically, this process has brought about a necessary and rather large reduction in the size of the research and development sector. The highest intensity of outflow from research and development institutions was recorded between 1991-1993, as the main results of the real migration survey show (67% of the total sample of 359 "traced" scientists left the selected institutions at that time). This survey also shows other, more general trends.

Data from the real migration survey prove that the external migration of Czech researchers, developers and university teachers is a marginal scheme in their professional career. Out of the total number of 359 employees who finished their labour contract within a given institution between 1988-1994 (the number excludes those who retired) only 14 persons left to work abroad, i.e. only 4% (most of them left to continue their scientific work). Regarding those who left for another job within the Czech Republic (the information was available for 303 persons), a majority of the scientists (47%) had found a job in the field of science, while half of them - especially young people - moved to the growing private sector. A quarter moved to public administration. The remaining roughly 29% is a rather differentiated group.

The survey with directors, deans and managers of scientific institutions (22 questionnaires were completed) which suffered from many objective methodological shortcomings proved similar trends: 1) Within the questioned institutions, the number of those who went abroad (to work there) between 1988-1994 was negligible. 2) When emigration was recorded, then, Germany, the USA, Canada, Switzerland and Great Britain belonged to the most attractive destinations. 3) Top scientific managers have no interest in external migration. 4) The scientists who moved out of the sphere in question have found new positions in the Czech Republic.

It seems that the present search for a new "face and soul" within the science sector has put a perhaps even greater burden on those scientists (including university teachers) who have stayed than on those who 1) have gone abroad (it is indicated that the whole number was really not too significant) or 2) to a much larger extent have Successfully" left the science sector for another occupation within the Czech Republic (mostly in the private sector, banks, consultant firms, etc.). Since the very beginning of the 1990s when the "great shaking and shake- , out" occurred, the research and development sector has now reached the second crossroads. Since the situation is more or less stabilized, one is now quite familiar with the new parameters" and, thus, can consider one's role in the "game". It is clear that presently the education and research and development sectors are underestimated in the Czech Republic. The share of the sector in the country's GDP is now about 1 %, ranking low among the advanced European countries. This is reflected in working conditions (financial, material, technical, etc.) for researchers and teachers.

The following picture, based on the main potential migration survey, shows the potential behaviour of Czech researchers/teachers. It also helps to formulate what basic future scenarios within the sector might be realized as to where and how to go.

As far as external long-term migration is concerned, 4% of the respondents (40, N = 915) intend to leave for a foreign country for more than 1 year and is preparing for departure. 9% (86) would like to do the same, but have not yet undertaken specific steps. Another 18% (167) would like to leave, but not now. The rest (68%) would prefer to stay in the Republic. When asking scientists in the Czech Republic: "What would you do if, in the course of the next few months, you receive an offer to go abroad?", 64% (N = 904) would prefer a fellowship for more than 1 year and a similar share (65%) research work for more than 1 year. However, only about 11% would accept it without any hesitations. Non-research work for more than 1 year is acceptable for about 35% of respondents. Mainly perfect working conditions and fair rewards for work, as well as comprehensive information about the potential destination influence the respondents, and attract them to highly developed Western democracies.

As for external short-term movements, 40% (N = 911) of the respondents intend to go abroad for less than 6 months and are going to be real 'brain exchangers'. To explain this movement a different set of conditions need to be taken into account. It is a normal, frequent and inevitable part of advanced scientific work.

When asking respondents: "Do you intend to change your present employer (institution) during this year (1995) if you stay in the Czech Republic?" (concerning internal brain drain), only 1% (13) answered "definitely yes" and 8% (73) "probably yes". 39% (363) of respondents said "probably no" and almost half of the sample, 49% (456) answered "definitely not". However, when a time horizon was not mentioned, it was indicated that approximately 25% of respondents might leave their present employer sometime in the future, the most frequently mentioned alternatives being private business research units (consultancy firms), another state research institution and public administration.

Regarding the potential loss of human capital in the science sector, the situation does not seem to be critical. However, the fact that nearly one third of the sector might be on the move to go abroad is worth pondering on. In addition, despite the fact that the above results on the internal mobility of scientists do not confirm huge movements, about one quarter of the respondents do not refuse to change their employer. This would be a loss for the scientific sector.

The interrelation between the working conditions for scientists/university teachers (including financial rewards) and their behavior (activity, leaving, resignation and the like) will determine the future of the sector¹. Much depends on government policy since -in our opinion- the science sector cannot be left with a fully non-interventionist attitude. Not only direct support, but also indirect support, such as creating reasonable conditions and an acceptable environment, is important. Also, the organizational structures themselves, such as autonomous administration within individual institutes and the human factor are important for the situation and climate in the science sector. National business communities, transnational corporations and

international organizations are also important in this respect.

Based on the results of the surveys we have formulated some basic recommendations for the improvement of the situation. The main goal of our endeavor should be to stabilize staff in the field of science and university education, to improve its structures and to make it more efficient and competitive, including the human aspects.

Recommendations for Czech bodies:

*It is vital to decrease the average age of staff in the science sector (including universities) significantly. This task is a difficult one, since it is precisely the young generation of scientists that is now more prone to leave the country or the educational and research and development sectors.

*To attract new scientists as well as to stabilize the sector (i.e. to prevent those who now work for the sector from leaving it and from leaving the Republic for a long time) scientists must be fairly rewarded for their formal¹ (not including additional) work. Salaries should be significantly higher than now. The Government should show its appreciation for the importance of scientists, an attitude which would correspond to the high prestige which this group enjoys within society. This step is important since the low living standard (or financial prosperity) of scientists seem to clearly be a "push" factor for leaving the country for a long period or to leave the sector within the country.

*Conditions for scientific work in the Czech Republic should be improved. This concerns in particular a good research infrastructure, up-to-date scientific information, and the availability of key publications. These features are a "pull" factor for emigration to the West. Working conditions prove to be quite important for the decision to leave an employer within the Republic as well. To meet such demands, there is a need to mobilize the inner resources of the respective scientific institutions/universities as well as a need for Governmental bodies to give more financial support for this purpose.

*The policy of promoting temporary short-term and long-term exchanges of scientists in order to allow them to gain experience in the West, should be pursued further. However, some "safety measures" for preventing the country's loss of scientists to the West should be identified and applied.

¹ Only about 24% (N=912) of the respondents claim they intend to always work (under any circumstances) in the field of science.

Recommendations for international bodies :

*The further development of co-operation between "Western" and Czech research institutes is very important. This could be done by increasing grants for high-performance institutes and individual experts from the Czech Republic and in improving the possibilities for both sides to work together (e.g. in joint research projects). Western partners should try to guarantee that what will be learned" (and perhaps partly achieved) abroad should also be Returned "to the Czech Republic. Also, attempts should be made to do joint research in the Czech Republic.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN:**

ESTONIA

I. BACKGROUND INFORMATION

I.. 1. ECONOMIC SITUATION IN ESTONIA

All the transition economies have shown a similar pattern of severe decrease of industrial output, high inflation rates, negative international trade balances, unbalanced budgets for the whole period from 1989-1994. However, 1994 has shown first marks of recession of these trends for most of the East European countries as well as for the Baltic states. Among the last group of countries, Estonia has shown the best results from the economic point of development in overcoming the unfavourable trends of the transition period [EBRD 1994; OECD 1993; UN ECE 1995]. One of the main characteristics of the recovery pattern is the development of the private sector. The share of output generated by private business activities has further increased in 1994, and accounts for more than 50 per cent in countries such as the Czech Republic, Hungary, Poland, Russia and the Baltic states [EBRD 1994]. Estonia has been together with Hungary, Poland and Slovenia among those countries which adopted a radical approach to reforms in the initial stages of the transformation and have put forward financial stability, a liberal market environment and a fairly efficient state as the key factors for their economic growth in the early stages of restructuring their economies. As an implication of the trends in economy during the transition period the development of science in that context should be borne in mind when evaluating the impact of the changes. First, having initiated the independent line of economic development already in the framework of the entity of the Soviet Union, it hampered considerably the development of science in Estonia at the early stages of transformation by reducing the available resources significantly. On the one hand, it made the quick restructuring of the scientific area inevitable. On the other hand, the reduction of funding has not been halted: in the budget of the country the proportion allocated for development of science has remained one of the lowest among all the East European countries. Secondly, 1992 has been for the Estonian economy the severest year, which was characterized by the deepest decline of GDP, sharpest decline in export volumes, highest inflation rate, decline in private consumption due to a significant loss of savings. On the other hand, 1992 is also a turning point for the Estonian economy, which was initiated by the currency reform in the

middle of 1992 and further liberalization, enabling to develop private ownership with great speed, a quick reorientation from Russia's market to Western markets in foreign trade. Thus, it also affected the restructuring of the scientific sphere. Until 1992 almost half of the funds for science outside Estonia came still from Russia, which together with the currency reform came to a halt, and made science quickly reorientate itself to other sources.

1.2. DEMOGRAPHIC SITUATION IN ESTONIA

Estonia and Northern Latvia have historically been among the forerunners of the demographic transition in Europe [Coale, Harm, Anderson 1979], One of the first nations in the world, Estonian population reached the underreplacement fertility in the 1920s [Katus 1991]. However, as marked by different population researchers [Coleman 1995] after World War II the historical Hajnal line has been pushed further to the West. During the last half of this century, social conditions have been very different from those in Western countries [Katus 1990; Zvidrinsh 1978], thus affecting significantly the basic demographic processes.

The development of the Estonian population has been greatly affected by WW II and, in particular, by the consequences of the war Estonia lost practical all its national minorities during WW II [Katus, Puur, Sakkeus 1997]. Being a nationally homogeneous country (Estonians accounted for 97.3 per cent of the population in 1945), Estonia has become a country of residence for more than hundred ethnic groups during the last 50 years due to large immigration flows from a tremendously

enlargened Eastern hinterland. Non-Estonians comprised about 40 per cent of the total population in 1989. The recent decline of fertility and changes in migration streams have contributed to the acceleration of population. Implications of the post-war demographic processes for the scientific sphere are mainly concerning the general trend of an ageing population. One of the highest proportions of foreign-born population in Europe (26 percent [Katus, Sakkeus 1993]) has had minor effects on the scientific personnel. Although the composition of the scientific personnel cannot be examined more thoroughly in retrospective terms, in its major part it has been of native origin: only 15 percent of the science personnel in 1989 was foreign-born and mainly engaged in the imported ail-Union scientific structures. The intermediate scientific structures imposed by the centrally commanded (mostly of military origin) ministries of the Soviet Union were not integrated into the local scientific environment, and with their withdrawal the personnel left together with the structures. Thus, the emigration to the East practically did not have an impact on the national scientific structure. Emigration for permanent stays in the West has been, and still is, very low in Estonia. This is mostly due to the early demographic transition of the Estonian population. The Estonian population, having passed the period of demographic transition, does not have a migration potential in its population structure, including the population engaged in science. The structure of emigrants from Estonia included mostly family migration and less educated people. However, the impact of temporary emigration has increased significantly. Mostly this aspect is paid attention to in the current survey, in order to estimate these volumes. The aim is to evaluate the patterns of temporary migration in regard to its direction and volume, identifying the competing areas, and place Estonia with its trends among the other East European countries.

1.3.THE REFORM OF THE R&D SYSTEM IN ESTONIA

The reform of the scientific establishment in Estonia was already started during the period of the declaration of sovereignty of Estonia (November 1988) in the framework of the entity of the Soviet Union. The first stage of the reform of science in Estonia was aimed mainly at introducing new principles of research funding, at building up a system of science councils and expert

commissions and at drafting the basic documents for the new structures. At the same time a thorough evaluation of science in Estonia, at first of research projects (1990-91) carried out by Swedish experts, and then of the institutions (1994) conducted by local commissions, was carried out. The reform of the whole research establishment created during the years of Soviet occupation, was being prepared. This stage ended in December 1994 with passing the Law on Research and Development and the Law on Universities in the Estonian Parliament (Riigikogu). At the same time, the restructuring of the institutional system of science was started.

The first key question was the re-organisation of the budgeting system by introducing financing of research projects and researchers in the form of grants. Another significant issue was the re-organisation of research establishments and the status and functions of the Soviet-type Academy of Sciences in the new economic and social environment. The third key problem was the reform of higher education establishments, the professional training of researchers in the new environment and the reform of the system of academic degrees.

In restructuring science funding, it was decided that during the transition period the institutions engaged in fundamental research must be guaranteed certain basic funds. At the same time the practice of grant-awarding should gradually be developed. Since 1993, the percentage of grants in total funding has increased every year reaching 28% in 1995.

In 1990-94, considerable changes took place in the research system of Estonia, mainly with respect to the former branch institutes and other sectoral research institutions. During the first years of restructuring the Estonian industry most independent scientific research organizations as well as construction and technology units in various enterprises have changed their field of activities and their form of organization. On the other hand, 10 new research establishments were located due to the disintegration of the "mother institutions".

Although retrospective comparative data is scarce and only some countries can be compared with regard to the structure of scientific fields over 10 years, the data reveal that Estonia has had different structures of scientific fields as compared to Latvia, Slovenia, Poland and Bulgaria over the time. Estonia is

characterised by a far larger share of social sciences together with humanities than all other countries examined.

The decrease of the number of people working in the sphere of science as well as the number of researchers and engineers (in Estonia) has been considerable. Among the Baltic countries, the decrease of the number of researchers was least in Estonia, 29% in 1990-94. In Lithuania it was 57%, and in Latvia 83% . It is clear that the critical border has been reached. Dynamics of age distribution among research personnel during 1983-1993 has been somewhat alarming: the share of aged researchers has been growing constantly and, correspondingly the share of people under 40 years has decreased. It is a serious problem which reflects the change of preferences of young people. However, it also corresponds to the general trends in the population development, where Estonia is showing rapid ageing trends. In 1994 the number of research personnel slightly increased, but it was rather due to the widening of the scale of institutions taken into account than to the increase of the number of personnel.

A policy for the development of science has not yet been defined [Martinson 1995]. The function of the Parliament is confined to drafting some (minimum) amount of money in the state budget for research. The Government's attitude has been mostly pragmatic: researchers must concentrate on current needs, on research supporting the national economy and solving local problems; basic research which requires large investments in equipment and supplies is not feasible for Estonia. On the other hand, the understanding that a state innovation system backed by state priority programs must be developed, is immature as well. The restructuring of industry has led to disintegration of large enterprises and to an almost total absence of demand for science by the newly shaped enterprise sector. Consequently, the money for science from the business sector has been reduced to nil. It will slow down the process of transition from a mainly academy- and university-based science to a science-based technology and goal-oriented research science. On the other hand, science in Estonia in many fields is highly competitive, also seen from the international scientific community. There are research groups in Estonia

doing high level research in the fields of condensed matter physics, astrophysics, chemical physics, molecular biology and genetics, as well as geology, biochemistry and some other fields. It is proved by the greatest number of EC, ESF and other grants per capita in comparison with the other Eastern European countries, by a comparatively high citation index and by electing our scientists as members of international organisations [Martinson 1995]. In 1993 more than 30 leading Estonian scientists were elected members of international science organisations.

IL REAL MIGRATION OF SCIENTISTS FROM ESTONIA, 1989-1994

Real migration surveys prove that during the transition period the sphere of science has experienced intensive personnel mobility. This was due to the objective restructuring process in Estonia, focused mainly on uniting basic research and higher education. That is certainly reflected by the higher exit rate from academic institutes compared to universities. Data from official statistics for 1994 indicate that this process is coming to its end. Another relevant feature of the transition period is the emergence of new scientific structures due to non-governmental or private initiatives. Among all countries under investigation, Estonia has the greatest proportion (58.8) of scientists who have left research establishments for another scientific institution, nongovernmental and private institutions gaining a significant share in the science restructuring process. This is clearly the highest proportion having remained in science compared to all other countries. Following Estonia, the Slovak Republic (39 percent) and the Czech Republic (34 percent) have already significantly lower proportions of this category. This phenomenon once more indicates that the effective liberalisation policy typical for Estonia in general in its transition towards market economy, has enabled new structures to develop in a relatively short period. Reorientation of funding systems from totally state-budget orientation to research project-oriented grant systems has laid the grounds for continuation of research not regarding its institutional ownership. As a conclusion it might be said that despite of the very restricted funding of science (allocations of science are the lowest proportion of GDP among the countries under investigation) during the transition period (or maybe exactly

because of that) it has not produced a flight from science, but rather helped to restructure science in a more efficient way. Estonia has one of the lowest levels of unemployment among the personnel who have left from scientific institutions. That corresponds to the overall policy of Estonia towards unemployment, where the benefits are kept at a very low level; in general unemployment rates for Estonia are comparatively low even for real unemployment (10-12 percent [Puur 1997]).

However, the significant proportion of those who have left during the transition period for a foreign country has to be paid attention to. Estonia stands third after Romania and Poland as to the share of the scientific personnel having gone abroad. Among those who have left almost 65 percent are continuing their scientific work, being remarkably high for engineering and technical sciences (81 percent). The latter have proportionately more contributed to this category with a greater share of those being older, with longer work experience and a higher proportion having a Ph.D. or higher degrees. The youngest have left natural sciences, among whom the share of those who is engaged in non-scientific work is also proportionately the biggest. Almost half of those who have left are engaged in neighbouring Scandinavian countries, which are very close and characterised by a relative similarity to the Estonian environment. Whether this phenomenon for Estonia means brain drain or rather brain exchange is hard to decide on the basis of these data. However the intensive international contacts in different fields of science, shown for 1994, where oversampled temporary 'foreigners' from one university comprise almost half of all the category for the year, rather points towards the exchange phenomenon.

The real migration survey indicates that Estonia is characterised by a big turnover of 30-34 year old scientists who have not yet thoroughly established themselves in their research environment and therefore are actively mobile between new emerging structures of science. The peak of Estonian scientific personnel's exit is in the younger cohort other than in all other countries under investigation. The same cohort also contributes mainly to those going abroad. Somewhat older and more experienced research staff is mainly contributing to the restructuring process between academic institutes and higher education establishments. The survey has also shown that the most steady age group which in Estonia seems to carry the scientific continuity, is 45-

49 years old researchers, who are the least mobile of all age groups.

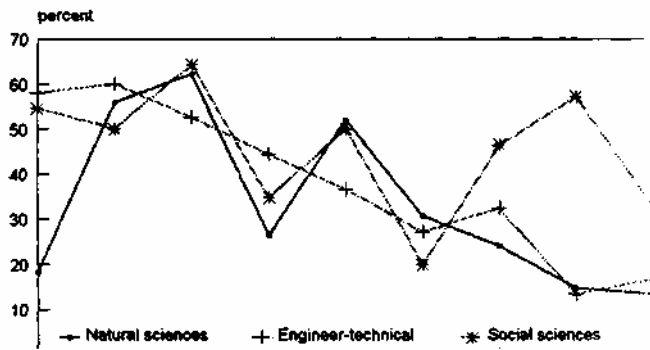
The transition period has clearly had the effect that science lost those to the public sphere who have not established themselves as scientists: this former scientific personnel is characterised by a lesser frequency of international contacts, greatest proportion without any specific research position, lesser proportion among them with Ph.D.s or higher degrees. Thus, the restricted economic situation has reduced the scientifically not established personnel, older in age, but less qualified. However, almost 30 percent reduction of scientific personnel has brought about certain gaps in the age structure, thus indicating the arising problem of discontinuity in some fields. The low allocation of resources to science in Estonia has contributed to the ageing of the scientific personnel to a great extent. If this trend is continued, it might produce a discontinuity of generations involved in science by the most active personnel leaving and new generations not coming in. The latter is the worst impact to science in Estonia, which might counteract all the effects of the so far quick and efficient transition.

POTENTIAL MIGRATION SURVEY, ESTONIA 1995

In general, the potential migration survey gives reasons to conclude that the Estonian scientific personnel has a quite low potential of any kind of mobility, which mainly results from its age structure. Research personnel in Estonia, having been reduced during the transition period by 30 percent, has no potential for intensive mobility due to the general advancement of the ageing process in its population. The restricted funding of science during the whole transition period has additionally reduced the proportion of new generations among the research personnel by halting the process of their entry into science. In Estonia, a significant proportion of post-graduate students are nearly 30 years old, which indicates a very late start of independent research life as a whole for the country. All these processes together have formed the research personnel of the current day, whose main characteristics is being one of the oldest research communities among the East European countries and with a significant proportion of those who have worked in the scientific field most of their working life. This is the basis for a generally low

potential for any kind of mobility, whether in the direction of foreign countries or inside the country.

FIGURE 1. POTENTIAL FOR GENERAL MOBILITY
 POTENTIAL MIGRATION SURVEY, ESTONIA 1995

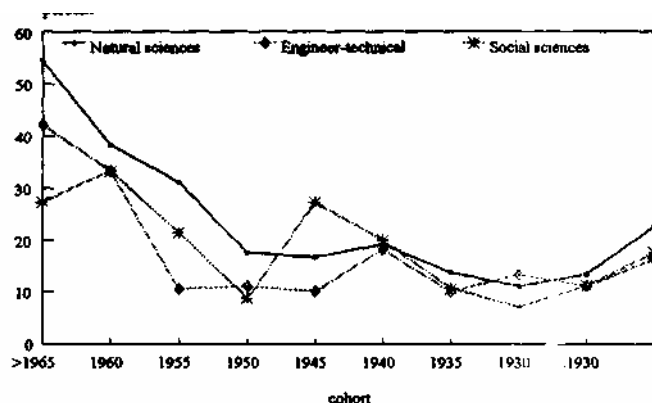


However, the survey offers the possibility to show the volume, direction

and pattern of the threat to the community under investigation, on the condition that all circumstances would favor the realization of potential migration. Although improbable from the viewpoint of real behaviour, as a warning, the scope of total potential mobility can be shown in three main scientific fields.

Social sciences is showing the highest probability of potential mobility with 44.4 percent, if evaluated by the readiness of changing their current employer. However, although the potential for going abroad is comparatively high as well (17.1 percent), the major part of the potential is realised inside the country. Another difference from other fields of science is that the potential for mobility is not significantly concentrated on a particular age, but is spread among all age groups. General mobility is affecting the most active cohort born in 1955-1959 (total potential of the cohort is around 65 percent). A potential for emigration is mostly shown by the cohort of 1945-1949, so far having been the most stabile cohort, if compared with the data from the real migration survey. This potential is remaining relatively high for all older cohorts, with social sciences being an exception from other fields of science.

FIGURE 2. POTENTIAL EMIGRATION BY SCIENTIFIC FIELDS
POTENTIAL MIGRATION SURVEY, ESTONIA 1995



Natural sciences are second with a general mobility potential of 36.1 percent among all personnel engaged in this field of science. The major proportion of the mobility is intended to be realised towards foreign countries (22.2 percent), especially in the younger cohorts. The mobility in

natural sciences is more a problem of the young; in the youngest cohort more than half intend to emigrate (54.5 percent, see Figure 2).

Engineering and technical sciences are closely following the pattern of the other scientific fields with 35.1 percent of potential mobility. However, as this field of science is already characterised by a significant discontinuity in their age structure, the potential is realised among the very youngest (the only field, which has a relatively high proportion of the youngest research personnel) and the oldest personnel (has also the highest proportion of the oldest personnel). It is hard to believe that such kind of potential could be realised currently in science; in case it would, in some cases it involves more than 60 percent of the cohort engaged.

Estonian scientists are older and with prolonged working experience in the field. It means that science has gained the core personnel, which in general has very clearly determined its perspective in this field of activity. Thus, on the background of relatively later beginning of the transition period, the high integration of Estonia's research personnel into the international scientific community does not come as a surprise. Any indication for the latter statement can be found in a higher proportion of those involved in joint international projects, and a high proportion of international contacts. Even the amount of publications abroad is higher than the average per scientist in Estonia, which speaks for itself. The scientific environment of Scandinavian countries together with its geographical closeness, insignificant language barriers and a similar environment in those countries have reduced the potential for real emigration.

IV. CONCLUSIONS

Both surveys have shown that the main orientation of mobility, whether realised or potential, is highly oriented towards science, which indicates how intense the reforms and restructuring in this field of activity have been.

The relatively high emigration rate in the survey on real migration, which does not correlate with the very low potential, needs to be paid attention to. First, Estonia differs from other East European countries by the age composition of real emigration. The age structure of emigrants does not correspond to the demographic potential in these age groups. Although the emigration rate of the real migration survey is high, it had not resulted in a corresponding gap in the scientific personnel's age structure by 1995. It seems that the significantly different age structure of those who have emigrated from Estonia during the transition period compared to all other countries under investigation, especially regarding the main peak in the 30-34 age group, needs a more thorough study. The survey on potential migration provides some insight into the category of those who can be regarded as determined emigrants, but due to the very low potential, it does not offer a full answer. However, a general explanation might be, that no matter how high the proportion of those who have emigrated is, they add to the significant flow of temporary exits into the international scientific environment, thus in the end contributing to the new structures emerging in Estonia's science. The latter statement is based on the very high proportions of short-term (up to 6 months) emigrations, concerning fellowships abroad, in connection with joint research work or a part-time job. Those who presently have a valid working contract with their home institute, but are abroad, form almost two thirds of the emigration flow for that year, which shows the high rate of turnover of international contacts. The neighbourhood of Scandinavian countries and the highest intensity of contacts with these countries suggest that the emigration might be regarded as part of the brain exchange between these countries. As the real migration survey did not take into account the entry and re-entry into the scientific institutions during the investigated period, it is hard to evaluate how many of the so-called emigrants have in reality returned. The age structure of

research personnel in 1995 suggests that the reduction of the personnel is mainly due to the fact that young people do not enter this field of activity.

The trends in real migration indicate that science has lost a high proportion of older personnel, whether by retirement (not shown in the survey data) or emigration and internal migration. However, due to the advanced ageing process the research personnel in 1995 has still become older. Internal migration shows that those who have gone into other fields of activities than science, have been rather less qualified and rather older than the young non-experienced personnel. Since the proportion of women engaged in science in general is already low, real migration trends have not generated any gender disproportions.

The turnover of personnel inside science is insignificant according to the survey data. The data from the real migration survey prove the high competitiveness of the new scientific structures. The structure of the personnel who is emigrating or moving into new science structures is close to general population characteristics. However, the potential migration survey indicates, that despite the highly research-oriented personnel who has remained in science, scientist look for much more possibilities of going into non-research areas and private business than the data from the real migration survey would show.

The Estonian data mainly refer to basic state research institutes: main universities and academic institutions which account for more than 85 percent of the research personnel. Both data sets show that the restructuring process mainly concerned academic institutions: real migration has been higher, reduction of personnel towards more research-oriented activities more visible, international contacts more intensive. The process can be understood since academic institutes were more oriented to fundamental research during the Soviet period. The reform of the R&D system in Estonia first concentrated on academic institutions. As the result the academic institutes have clearly benefitted from that, their personnel being relatively younger and more qualified. However, the potential migration survey shows that personnel in universities is changing as well. However,

when looking at their international contacts, it becomes obvious that personnel in universities is much more oriented towards training than that of basic research institutes.

As a conclusion, the project showed that Estonia has a different position compared to other East European countries in many aspects. Belonging to the group of countries whose transition towards an open society has started relatively late, Estonia still belongs to the forerunners in the science reforming process and the rate of integration into the international research community has been very high. The effects of the transition period in general terms show the high speed and effectiveness of restructuring processes in the country. Estonian research personnel has become more homogeneous, determinantly research oriented and losses have contributed to form a better qualified and experienced personnel in science. In that sense the economic restraints of the period, which have been the highest compared to the other investigated countries, had a positive effect. Nevertheless, one of the main negative effects of the period has clearly been that no new young personnel came into science. If that trend is going to continue the positive sides might turn into a real problem. The balanced reproduction of human capital is a crucial point in the general development of a small country. The low potential of mobility is the result of the demographic development of the population. Ageing of the Estonian research community undoubtedly leads to further reduction in the number of scientists. Estonia's task is to attract more young people into science, if the country wants to maintain the international competitiveness of its scientists.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

HUNGARY

1. The Hungarian study had 3 major empirical elements:

- a) A survey of migrating and/or planning to migrate researchers;
- b) A survey of the contacts of the Hungarian scientific elite (the best 500 scientists) with the international scientific community (international research contacts, fellowships, grants, foreign co-operative networks, etc.);
- c) A survey of the intentions to emigrate and work abroad on the basis of a representative sample.

2. The central finding of the Hungarian report is that within the global system of academic research the flow of labour between the core and peripheries and semi-peripheries is a permanent feature, which is influenced by political factors. With Eastern Europe being reintegrated into different international networks (usually not as part of the core, but as part of the semi-periphery), the migration of researchers developed in an organic way. The process is more dependent on changes drawing capacity from the core, then on the development of the internal organization at the periphery. In other words: the key variable is the pull from the core, not the push from the periphery.

3. Though, at the beginning of the 1990s the economic and social environment in Hungary changed dramatically, the traditional Hungarian research system managed to rest on two pillars. Its basic structure, most important institutions and determinant centres of work continued to operate. In spite of all the well-known problems, there was no panicking in the operative parts of the system, and perhaps this is why, after a short period in 1990-91, questions such as "to be or not to be" and to go or to stay "type did not emerge as determining issues in the daily practice of science policy. It must also be remembered that before 1989 the Hungarian science system --like those of Poland and Yugoslavia respectively— were not cut off from the world's scientific communities. This is why --at least among the research elite and the most important institutes and scientific centres--there was a much clearer picture about what to expect abroad than in other parts of Eastern Europe, whose scientific systems really were cut off. Part of the investigation was difficult due to the fact that, as a consequence of the relative openness of Hungarian science before 1989, the most intensive periods of brain drain were experienced during the 1980s. At that time, scientists from Poland were the only competitors for Hungarians on the Western academic labour market, as far as Central and Eastern Europe was concerned. As a consequence, a significant number of researchers, capable of competing on the market, had already left before 1989.

4. We found out that age was the most important parameter influencing the behaviour and life plans of scientists, and not the division by disciplines or the branch structure.

5. Among natural scientists, publication activities are exclusively directed towards abroad. Papers, contributions for books and lectures in international conferences have become almost the only criteria for success (grants, promotions in the national system), not only for the research elite. It seems that these criteria apply to some researchers in other centres of research as well. 14% of the sample of scientists used for the study have no foreign publications. Nearly two thirds of the researchers participate in networks of international co-operation and in international conferences. At the same time, it is also important to note that one third of those surveyed have no chance to go abroad for longer study trips, or to participate in international conferences. Only 7-10% of the respondents were involved in long-term foreign trips at the time of the survey.

6. Hungarian state resources play a remarkably important role for the most important international projects. Even when considering that this internal support is higher for sure" Hungarian projects, it was an illusion of Hungarian science policy circles to believe that foreign resources would be crucial for the survival of the national research system. The international patrons of Hungarian companies are not particularly generous with regard to this support. (The resources from foreign joint-venture companies are more important). Funds from different programmes of the European Union are the most important among foreign support, constituting one quarter of all financial project support. For the institutes of the Hungarian Academy of Sciences, but also for other research centres, support from the USA is very important as well.

7. English is the dominating foreign language, not only among top researchers but generally speaking. However, we can notice different samples in the older and younger aged groups. Researchers over the age of 40 have significant knowledge in German and Russian; those under the age of 40 usually have less knowledge of a second foreign language. With some exaggeration, it might be said that in the community of researchers over the age of 40 there is a high degree of multilingualism (and this does not exclude English). The younger generation obviously wants to learn only one language -- the pidgin" English of the international scientific community.

8. Foreign positions and professional careers are 1.5 times more attractive to the younger generation than to older people. As to prestige or safety of jobs, both younger and mature generations have lower "expectations" with regard to an international career. The essential point is that 80% of the respondents under 40 years of age thought that they could only realize optimal research infrastructures and financial possibilities abroad. On the other hand, 50-60% of the young generation considered that respect could primarily be gained from within the Hungarian research system. The majority of the Hungarian research community know that their personal ambitions can more likely be satisfied abroad (than under the present Hungarian circumstances). However, they are still deeply attached to Hungary. In other words, international science centres, despite their ideal working conditions, do not stimulate emigration or separation from familiar research communities. 63% of those over 40, and 81 % of those under 40, think that their aims can be better achieved abroad.

9. Our second survey was intended to provide answers to the following basic questions relating to the international connections of the research elite.

a) Can an "export oriented" layer be identified in the Hungarian science community? If such a layer exists, does it primarily work for the international market, does research with international resources and therefore is outside-oriented as far as connections are concerned. On the other hand, are there those in the research elite who work mainly for the local market, without requiring all the above connections and publication channels?

b) Does research support from abroad have an additive, complementary role in financing Hungarian research, or are there some research groups which can exist without any domestic resources?

c) Given the comparatively liberal political climate in Hungary during the 1970s and 1980s, was the scientific elite of that time able to integrate western connections and support which they were permitted into their professional lives? Were the earlier opportunities for research, scholarships and related work abroad a creative support to research careers? Or were such opportunities badly connected with daily research programmes, being only profitable for the lifestyle of the research elite, but having no substantial influence on ongoing local research

How was brain drain perceived among this elite? What was the earlier extent of "emigrational drop-out" among the elite? Was it possible to realize within the Hungarian research system -- being itself on the periphery of the international system -- a career style which, with intensive international connections, made emigration unnecessary? Were the advantages of brain drain lasting or temporary?

We were able to identify two types of elite: one was "functional", while the other was "positional".

10. Movements linked to changes with regard to the standards of research work and the general circumstances for research are experienced by the research elite in a contradictory way. Documents regarding scientific policy and the opinions of researchers are equally reflected in public: "... the conditions for research are getting worse, but we will clench our teeth and thus we will complete and improve our results". This is the determinant attitude. However, in evaluating their work on the basis of a comparison of the respective levels in 1990 and 1995, the research elite holds opinions which are opposed to the above attitude. According to the comparison, the achievements of our own research work were better in 1989-1990 than 1995 (some parts of the elite have another opinion -- for example, the positional elite cannot see any changes, while the functional elite feels that there has been a significant deterioration). With regard to research techniques and information flow, it is generally felt that during 1990-1995 there has been a considerable improvement. The various types of communication and information now available are particularly appreciated in this connection. Despite the decrease of financial support, all the elite groups feel there has been an improvement as far as the technical environment is concerned.

However, it is worth noting that not one elite group holds the opinion that working conditions are at least average compared to international research conditions, certainly

not above it. 30%-40% of the elite think that their conditions of work can be compared to the international average.

11. The elite group who is determined to compete internationally has international connections which are extremely good. To put it in a simplified way: the research elite constitutes an identifiable export sector which, to a large extent, has primarily arisen due to studies published abroad, but which have been financed with the support of domestic resources.

12. Over the last three years the respective funding gained by elite groups from domestic and foreign sources was equally high as far as overall budgets were concerned. According to the general opinion, domestic scholarships went primarily to either young researchers or to those with a lower status. Therefore such resources are regarded to be supplementary to funds for more senior researchers (3/4 of the latter did not even apply for such resources and altogether only 6.2% received such funding). However, the situation is different with regard to foreign scholarships: 1/4 of the respondents had gained foreign scholarships lasting longer than a month during the past three years. Positions as guest researchers were gained by the functional elite and positional elite in similar proportions: 37%-42% of the respondents had traveled to work abroad every 1-3 years, while 42%-54% rarely got such chances (i.e. once every five years or less). In the opinion of the overwhelming majority of researchers it is necessary to work abroad at least once every 1-3 years in order to maintain appropriate connections. However, during the past three years 40% of respondents had not been on a research trip abroad for a period longer than one month, and only one fifth had used such opportunities frequently. However, the "double life", working parallel at home and abroad, was considered as a maximal condition by less than a fifth of the respondents and only 1/10 regarded such a situation as being feasible (among the functional elite this proportion was slightly higher). 27% of respondents regarded the described "double life" as being undesirable.

13. It seems that, on the whole -- at least in the circles investigated here -- the aim of emigration is not a strategy for life. If ever it was, it has not materialized and, given the ages of most of the members of the various groups, it would be difficult to realize. Here the "exodus" did not become a strategy (and within the whole sample it was not possible to distinguish a stratum which, on some basis, could be identified as pre-emigratory). The real decision to emigrate could not be traced, due to various technical inflexibilities in the questionnaire. In any case, we can assume that those for whom the thought of emigration turned into a real life strategy, had already gone.

14. National data show that working abroad and emigration have not become accepted and culturally supported strategies in contemporary Hungary. Thus, intentions to migrate are only valid for certain groups to a limited extent. Migration potential in Hungary is not high; it is rather stable at about 6 percent. The part of the population which intends to migrate mostly claims economic reasons. Those who plan to work abroad choose their target countries from among Western countries geographically close to Hungary. Those who plan to emigrate aim at welfare societies or traditionally receiving overseas countries. The description of the group that intends to migrate is familiar from other studies dealing with migration potential¹: compared to the total

population, their average age is lower, their educational degree is higher, they come from urban areas, and the ratio of men is higher than that of women. Their situation on the labour market is relatively bad, their average income is low, many are looking for jobs. So, on the one hand, a well educated, dynamic group wants to attempt migration, while, on the other, this dream appears as a last option for those who are in a disadvantaged position.

This explanation is supported by the fact that more of the disadvantaged group abandoned their intention to migrate in the course of one year. Although certain groups were more stable, the majority of respondents who planned migration abandoned their intention from one year to another. This suggests that measuring migration potential is not, at least in the short term, a reliable method of predicting the magnitude of migration movements.

¹ Brym, Robert (1993): Csehszlovakia, Magyarország, Litvania, Lengyelország és Oroszország emigrációs potencialja. In: Utkeresők (Roadseekers), Sik, E. (ed.). Yearbook of International Migration Research Group, Institute of Political Science, Budapest, pp. 9-18

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

LATVIA

Latvia is one of the smallest former socialist countries - with a territory of 64.5 thousand km² and 2.5 million population (as of 1995). However, it had its developmental peculiarities, both when incorporated in the former USSR, and in its transition period to a free market economy.

In the transition period the percentage of the state budget allotted to science was severely cut: from 1.3 per cent in 1985 to 0.9 per cent in 1990 and 0.8 per cent in 1993, but in 1994 it was 0.9 per cent again. The renewed state carried out a financial reform in science, shifting from the financing of an establishment as a whole to the system of grants awarded on the basis of competition. The applications in every research branch are now being assessed by expert commissions, elected by the scientists themselves. With the help of this system less significant investigations for development of the country are turned down, so are less active and successful researchers.

From 1990 to 1994 the number of research staff, counting their full time equivalent employment, has diminished 2.7 times and does not exceed 0.5 per cent of the total work force. The average salary in science in 1985 was the average salary level of the national economy; in 1990 it exceeded it by 21 per cent; in the middle of the 90-ties, it was reduced to 65 per cent of the average remuneration for state-employed staff. In 1994 the average researchers' salary at the basic employment place was 40 Ls monthly, or 73 USD, which does not reach the subsistence minimum. Scientific personnel is forced to do odd jobs, and even several odd jobs. According to the survey data every scientist has 1.5 additional jobs; 24.6 per cent of odd jobs are not connected with their basic employment or profession. An additional job in some other scientific establishment or research project increases the total workload extremely, which can have negative effects not only on the potential to work, but also on work results.

Due to limited financing resources and the low pay, the number of research staff diminishes, with staff retiring or moving to some other job or emigrating, and what is worse, there is no generation replacement. As a result of this the average age of people employed in science has increased from 40 years in 1979 to 43 in 1989 and to 48 in 1995.

Scientist emigration

For the survey 14 institutions with 20.4% of Latvia's research staff and university teachers (as of 1994) were chosen.

According to the data provided by personnel departments, 702 persons or 7.5% of research personnel has been lost; of which 2.1% have left for another job or have emigrated. There is no information about the new work-places of 40.5% of

the migrants. However, it can be assumed that the same part has emigrated. In this case the total rate of emigrants would amount to 3.6% of the total number having left science for other work places.

From the 14 research institutes and university faculties selected for the survey, information on emigrants was only received from 4, respectively 28.5% of the establishments. A similar personnel loss due to migration was also experienced in the institutions chosen for test-check : only 1 out of 5.

Over the last 7 years most scientists have emigrated from Latvia to Israel, the USA and Canada, also to the CIS, less to Western Europe. During the first phase of the period under discussion, up to the renewal of state independence (in 1991), there was a dominant move to Israel and the CIS, after that the prevailing emigration direction was the USA and Canada; also the percentage of people going to European countries, Germany and Sweden, has increased.

The intensity of extreme migration is limited, both by immigration restrictions existing in Western countries, and also by a lack of readiness to emigrate on the part of Latvian scientists.

It is clear, that the interest of foreign colleagues in having somebody from Latvia to do research work with them, is based on the results of previous co-operation.

According to the available data, 119 out of 808 research staff from 14 institutions spent time abroad, i.e. 14.7%. Of which 42.9% participated in conferences a.o. meetings, 26.0 % did short term and 12.6% longer-term (more than 3 months) studies; 11.8% were involved in joint research work; 4.2% were guest lecturers; 2.5% were involved in post-university studies.

The variety of countries visited, in correspondence with the frequency of contacts, is much greater than the few new home countries of those who have emigrated : more than 15, mainly European countries were visited during the 2 months when the survey was conducted. Visits are mostly made to countries to which Latvian scientists have emigrated : Germany - 21.8%, Sweden 13.4%, USA and Canada 9.2%.

When asked about the influence exerted by visits abroad on the research programmes of their institutions, 86% of questioned heads of institutions assessed it positively. Some of them based their assessment on the exchange of experience, as a possibility to use better equipment, to obtain new information, to widen international contacts, as well as, getting rid of the illusions about the superiority of research work in the West.

Potential Mobility of Scientists

610 persons, which is 15% of scientists employed in Latvia in 1994, answered the questionnaire on potential migration.

Real preparation for emigration is lower than the verbal readiness to accept emigration offers. Evidently, the number of such offers is not very high, and the conditions are not always acceptable. Determined migrants constitute only 1.5% of scientists, most actively engineers, less actively social scientists. 8% have planned emigration, but practically have not started to deal with it, and 6.9% have made up their minds to emigrate after some time. These might be called undetermined migrants.

The majority of those who have planned to leave sooner or later - 80.7% or 13.0% of all respondents - plan to stay abroad not longer than 3 years and only 6.2% of all potential leavers or 1% of all respondents have planned to emigrate for good.

Opportunities abroad are sought with the help of relatives, friends and colleagues (20.5-21.4%); using advertisements in specialised journals (20%) and the help of international organisations represented in Latvia (17.7%) is another way to emigrate. People who have planned to emigrate use several means of realising their wish.

Germany is being chosen for a longer stay by 31.3% respondents, in particular by social scientists; the USA follow with 23.9%; Scandinavian countries with 12.9%, Great Britain with 9.8% and Canada with 9.2%; the rest of West European countries with 10.4%. Better work conditions (70.7%), high living standards and good remuneration (67.7%), corresponding language skills (65.8%) are given as reasons to migrate to a particular country. Reasons such as job opportunities, knowledge of the circumstances after previous visits (40.8%), anticipated assistance from relatives and friends (40.2%), neighbourhood to Latvia (31.1%) are other reasons.

The majority of potential migrants have clear ideas about their occupation abroad, among them, work at some research centre, further qualification in one's speciality and participation in a joint research project.

Among potential, but undetermined migrants, the majority is men with PhD degrees. As a rule, they have larger families and judge their economic situation as being good. They have, more often than the rest, admitted that their material status has improved during the transition period, and they have less frequently evaluated their position in society as lower than average. This potentially more mobile group of scientists is characterised by relatively better command of the English language, better familiarisation with modern technical infrastructure. They also show the greatest rate of paid odd jobs, a comparatively smaller basic job salary, and on the average have more living space per 1 family member.

Potential undetermined migrants visited foreign countries more often than other scientists; 1.3 and 0.4 times more according to the survey.

Making one's decision for or against a long-term stay or even emigration requires to weigh possible gains against possible losses and obstacles. For all scientists the most difficult obstacle to overcome is the separation from their families. For determined migrants the administrative problems in the host countries also cause difficulties, and they worry about health problems and about the non-recognition of their diplomas. Undetermined migrants have assessed different circumstances as causing obstacles more often than determined migrants. Among them the separation from their families, expected homesickness, a risk to lose good opportunities in Latvia, doubts about one's professional competence, health and diploma recognition.

Most worried about their professional competence, homesickness and diploma recognition are social scientists, least of all engineers.

Unwillingness to leave Latvia for a year or a longer time does not mean the refusal of short-term trips. 22% of respondents are getting ready for such trips, which is 34% more than those planning longer stays.

It might be concluded that Latvian scientists do not desire to leave their country. Readiness to be away for longer than a year have expressed 16.4% respondents. Of which 19% or only 3.1% of all respondents would take up some other occupation during the stay-away period which should be regarded as a loss to science.

By supporting research in Latvia, interested Western countries would assist qualified scientists to stay in the country. This would cost less than brain drain.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN.**

LITHUANIA

Political, social, and economic changes in Lithuania which started in the late 1980s were an impetus for decisive changes in the development and status of science and for the changes in scientists' mobility, both in professional and career (academic and non-academic) as well as in the geographical sense. Administration, funding, structure, research trends, priorities, the role of science in society, everything changed. Political changes and the re-establishment of the independence of Lithuania have provided an impetus for a reform in science. The principal aims of the science reform, implemented since 1990 are: integration of research and higher education; autonomy of research and higher education institutions; orientation of research towards the needs of Lithuania.

Funding of Lithuanian science has decreased in recent years. The procured resources are not adequate even for paying salaries and running offices, not to mention the acquisition of new equipment, materials, instruments, research expenses. Salaries in research as compared to many fields of economic activity are low, and even lower than average in the public sector. However, Lithuanian science has been experiencing such a hard transitional period not only due to economic problems but also because of the absence of a consistent and long-term science policy of the government.

This way, political transformations, economic difficulties and an unstable situation in science have conditioned rather high real and potential indicators of scientist mobility. At present quite an intensive flow of scientists to other branches of the national economy as well as a sizeable emigration is observed. Besides, these processes can be frequently characterised as brain loss rather than brain drain.

REAL MOBILITY OF SCIENTISTS

With the decrease of funding and an uncertain situation in science, the number of personnel in scientific institutions has been decreasing. Instability pushes researchers into other fields of activity. The changed political situation in Lithuania had the greatest effect on those branches of science and research, which had been most integrated into the economic, scientific and ideological structures of the Soviet Union, especially if they had been conducting research for military purposes. Changes in Lithuanian economic and governmental structures, and the strengthening of statehood have strongly influenced the mobility of researchers in social sciences.

Resignation from employment in engineering and social sciences fields was the most intensive: in 1988-1994 correspondingly 36% and 35% of scientists left the institutions in these domains. The mobility rate of scientists in natural sciences institutions was much lower -17% only.

Several schemes of scientists' mobility can be seen. The two principal ones are: emigration (14%) and mobility of scientists inside the country (86%). These main schemas split into several different sub-schemas.

External mobility. In Lithuania two radically different schemes for realising emigration of scientists are distinguished:

- Departures to the former USSR, notably Russia, to well-known conditions or even one's ethnic homeland. Thus no particular efforts are required to realise this kind of emigration;
- Emigration to Western countries, which is effected in several stages: temporary migration in the initial period and a permanent migration in a later one, i.e. a shift from brain exchange to brain drain or brain loss.

The peak in scientist emigration was registered in 1992. The latter correlates with the peak of the overall emigration of Lithuanian population. However, whereas at national level an evident reduction of the emigration of the population has been observed since 1993, scientists' emigration is decreasing much slower.

Russia was the main country of destination for scientists in 1988-1994 (22% of all emigrated scientists). The most popular Western countries were the USA (19%), Germany (9%) and the Scandinavian countries (7%).

Nearly half of all emigrated scientists have been engaged in scientific activities abroad. However, approximately one sixth of all emigrants have undoubtedly become "brain waste:" engaged in non-scientific, sometimes unqualified work. Two thirds of the emigrated scientists are men.

The majority (64%) of emigrated scientists are between 30-44 years. The education level of the emigrants is very high: as many as 43% have doctor's degrees and above.

Social scientists depart most often (15% of all resigned from scientific institutions of this field), and engineers and technicians - least frequently (12%). The following domains prevail among the emigrated scientists: culture and arts, electronics and automation, mathematics, physics. Experts in the field of culture and arts, mathematics and automation mostly leave for the West, while experts in electronics and philology leave for the former USSR. The latter stream is a conspicuous result of the dissolution of military and ideological structures as well as the repatriation of the Russian-speaking population. Western countries are preferred by top scientists and artists, the former USSR by highly specialised scientists.

Internal mobility. Several schemes of internal mobility of scientists, representing all the range of scientists mobility - brain drain, brain loss, brain exchange - have been revealed:

- **The first** scheme of internal mobility of scientists is obviously connected with the accomplishment of one of the principal ideas of science reform in Lithuania - integration of research and higher education. A redistribution of researchers in favour of universities (higher education) is taking place.
- **The second** scheme of internal mobility of scientists is often implemented at the conjuncture of horizontal and vertical mobility: a career outside science. During the transitional period of strengthening citizenship scientists move to governing structures, the top-ranking governmental posts included.

- The third scheme of scientist mobility, which is not always chosen on a voluntary basis, is move of scientists from science to other fields of activities: business, services, commerce and then into "shadow" economy.
- A fourth scheme of scientist mobility, not easy to identify, is obviously manifesting itself in Lithuania. This can be called combining scientific and non-scientific activities, usually at the expense of scientific quality.

The main mobility flows of scientists who left research and higher education institutions but remained in Lithuania between 1988-1994 were directed to: other state research and higher education institutions (22% of all departures from research and higher education institutions); government (14%); private sector (12%); social service (3%); unemployment (3%).

POTENTIAL MOBILITY OF SCIENTISTS

Potential external mobility of scientists. Emigration potential among Lithuanian scientists is rather high, - over 80% of scientists would like to move abroad for a period longer than one year. However, the majority of scientists would accept an offer to go abroad only in case it was related to some research work or perfection of their skills, but would decline an offer for non-research work. Therefore future migration of scientists will more likely be related to brain drain, not brain loss. On the other hand, realisation of this potential may be significantly lower - according to survey data less than 5% of respondents have undertaken any steps to emigrate.

Migration attitudes of experts from various disciplines seem to be rather similar, and do not depend on the administrative post, academic title, degree or other scientific characteristics.

Scientists' attitudes towards a possible long stay abroad to a considerable extent depend on their notion of the demand for all kinds of scientific output in Lithuania, and of its potential users. Scientists who think that their work is needed within Lithuania are less inclined to emigrate. In contrast to this group are scientists, who see possible users of their work output abroad, e.g. in foreign organisations. They more frequently prefer emigration. In addition, previous experiences obtained through past trips abroad as well as through common work with foreign colleagues in joint projects encourage future trips.

If socio-economic factors are considered, it is possible to say that emigration of scientists is caused by the general situation in Lithuania rather than by the specific situation in science. Working conditions hardly correlate with potential emigration scope, whereas financial difficulties of the family can serve as a push factor. Emigration as a possible solution of such difficulties is mainly resorted into critical circumstances, while good job opportunities in Lithuania prevent scientists from moving abroad.

Potential internal mobility of scientists. Approximately one tenth of all scientists are potential internal migrants. Taking into consideration the fact that in 1988-1994, the years of the most intensive structural changes of science, more than one fifth of the scientists from sampled institutions had already changed the job inside the country, this internal mobility rate marks a continuing instability in science. About one fourth of those who want to change the job intend to transfer to another scientific institution, and the rest intend to move to other fields of activities. The majority of them want to move to their own private business; a sizeable part to private employment. This clearly indicates that the present and expected instability of Lithuanian science, particularly of research institutes, as well as socio-economic circumstances may even stimulate the internal mobility of scientists in future.

Nearly one third of the scientists intending to change the job can be regarded as brain drain, and two thirds as brain loss.

Engineering and technical scientific institutions remain most unstable. The situation of scientists in social and natural science institutions is slightly more stable. Engineering and technical institutions are expected to produce the highest brain loss (71%), social science institutions the lowest (59%).

Due to the ongoing reform of science in Lithuania, the key principle of which is integration of research and higher education institutions by linking research institutes to universities, and a sharp decrease in research funding, the greatest internal mobility potential of scientists is observed in state research institutes (13% intend to leave their institute in a year) and in other research institutions (28%), while in the universities it is the lowest (8%). Correspondingly, determined non-migrants are 69%, 61% and 81%.

Persons with no scientific degrees (only M.Sc.) and under 40 years of age intend to leave scientific institutions most frequently, whereas scientists with higher than doctors degrees are most stable. The higher a scientific degree, the lower the potential mobility, and, consequently, fewer intentions to move to non-scientific fields and fall into the brain loss category. However, this is less an expression of stability but rather of a reduced opportunity - due to advanced age - to move from the presently unstable, low-income science domain to other fields. At the same time quite a considerable number of young and middle-aged scientists, mostly men, are still inclined to leave science.

Women about twice less than men are prone to leave scientific institutions. Besides, women fall into the brain loss category much more often: 75%, compared to 59% of men. Most potential internal migrants are scientists in stringent economic circumstances.

BRAIN EXCHANGE

International mobility rates of skilled and talented people are very high in Lithuania. Over the past seven years nearly 50% of Lithuanian scientists have experienced brain exchange.

The most common and widespread trips abroad are related to participation in conferences, seminars, workshops, etc. Scholarships and short-term (less than 3 months) studies abroad are also rather common in Lithuania. They are followed by migration for the purpose of participation in joint research projects or joint research work. Other forms of brain exchange, especially those implying a longer stay abroad (post-graduate studies for more than 3 months, studies to obtain a doctor's degree, permanent part-time jobs abroad), are less typical for the Lithuanian academic community.

In comparing mobility experience of experts from various scientific fields, differences become obvious. Social scientists turn out to be most mobile, whereas scientists from engineering and technical disciplines have the lowest migration experience. On the other hand, the latter outnumber other scientific fields by the proportion of people having permanent part-time job experience abroad.

Brain exchange could be even more pronounced, but for the difficulties of finding financial assistance. At present the majority of all foreign trips are sponsored by host organizations or other foreign funds. Local financial sources play an insignificant role, the situation being similar in all scientific disciplines. Despite the above-mentioned financial dependence on foreign partners, brain exchange of Lithuanian scientists does not promise to be less intensive in future, and over 1/3 of respondents of the survey intend to move abroad (temporarily, up to 6 months) in future.

During the 1990s brain exchange has changed as far as host countries are concerned: migration to the East has drastically decreased, while migration to the West has increased. The data of the survey show that this will not change in future (nearly 80% of foreign scientific trips are forecasted to be made to Western countries).

Other forms of collaboration with foreign scientists, e.g. participation in joint projects, publications in foreign journals, etc. are now becoming quite widespread among Lithuanian scientists. The Scandinavian countries, Germany, France, the USA and the UK could be mentioned as the main countries of collaboration.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

POLAND

I. Introduction

The PECO/COST migration project is the most comprehensive project in a recent series of sample surveys on the actual and potential migration of scientists during Poland's transition to a market-based economy.

Earlier investigations used very brief questionnaires and focused mostly on migration of scientists during the period preceding the collapse of the communist regime and/or covering the first years of political and economic transformation of the country¹.

In Poland the political and economic crisis of the eighties led to a huge wave of migration. Official statistics seriously underestimated the extent of this phenomenon, as only those individuals were recorded who filed official papers, and declared that they were leaving the country for good. The actual number of emigrants is estimated by independent researchers at 1.073 to 1.317 million between 1980 and 1989, absorbing 36.4 to 44.7 % of the population growth. Emigration was highest in 1988 and 1989². Emigrants with higher education degrees constituted 6.6% of officially recorded migration, but were as high as 13.0% of the much larger, officially unrecorded migration. No statistical data exist regarding migration of scientists. Emigration of scientists was at its highest between 1981 and 1984; less so by half between 1989 and 1991. The PECO/COST research provides fresh data on emigration of scientists in the years 1988-1994 and undertakes an investigation of professional mobility and potential migration of scientist during a period of Poland's fast growth and transition to a market-based economy.

II. Characteristics of the sample

The sample surveys covered Warsaw, Poznan and Lublin. Warsaw is Poland's biggest university centre and a major area of science and research and development activities with more than one third of the country's science and research personnel. Poznan and Lublin represent two of the country's seven larger provincial universities and research and development centres. These two cities share one common feature of interest for the present study. In earlier research on migration of Polish scientists during the pre-reform years, these two university centres have been recorded with the lowest emigration rates, respectively 4.5 and 6.3 per cent. Warsaw with 10.5 per cent of foreign drain was ranked above the national average of 9.5 per cent³. On the other hand the Poznan and Warsaw scholars were recorded in earlier studies with the highest reported success rates for continuing employment in science in post-emigration careers. The Lublin scholars were recorded among the lowest rates.

¹ Janusz Hryniewicz, Bohdan Jalowiecki, Agnieszka Mync. Ucieczka mozgow ze szkolnictwa wyzszego I nauki (The Brain Drain in Poland), Uniwersytet Warszawski, 8(41), 1992; Bohdan Jalowiecki, Janusz Hryniewicz, Anieszka Mync, Ucieczka mozgow z nauki I szkolnictwa wyzszego w Polsce w latach 1992-1993, Raport z badan (The Brain Drain from Science and Universities in Poland, 1992-1993), Uniwersytet Warszawski, 14(47), 1994.

² Marek Okolski, Migracje zagraniczne w Polsce w latach 1980-1989. Zarys problematyki badawczej. Studia Demograficzne 3(117) 2994.

Transformation to a market-based economy is progressing in Poland at an uneven pace with regard to its regions. Warsaw and the Western part of the country, including the Poznan area, are enjoying recovery, while the city of Lublin and the Eastern part of the country are behind as far as economic transformation is concerned. Transformation and adaptation of the science and research and development institutes to a market-based economy show similar trends. The combined Warsaw, Poznan and Lublin sample provides a representative picture of the country's diversified development and migration trends.

The survey sample consists of a population of scientists employed in 49 institutes, with 30 institutions representing Warsaw, 13 Poznan and 6 Lublin. The overall sample represents approximately 10 per cent of Poland's scientific personnel.

The sample quite well approximates the country's research staff engaged in R&D work and its distribution between the natural and technical science, but underrepresents the social sciences.

University employees are underrepresented in the overall sample, particularly in the case of Poznan and Lublin.

The overall survey sample (the total for Warsaw, Lublin and Poznan) for real migration of scientific personnel in the years 1988-1994 consists of 1344 questionnaires and that for potential migration of 1174 questionnaires. The same institutes participated in both surveys.

III. Real migration, 1988-1994

A. Internal migration

During 1988-1994, a dominant, declared reason for leaving employment in a scientific institution was the transfer to another state or non-governmental research institute or to business and consulting companies. The internal movements to such a broadly defined research sector accounted for more than a quarter of all migration during the period under investigation.

¹ Bohdan Jalowiecki, *et al op. cit.*, p. 139

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

SLOVAK REPUBLIC

1. Objective

The main objective of the brain drain project was to provide a precise analysis on topics related to the loss of highly qualified staff from academies of science, universities and research institutes.

2. Methodology

The research strategy and the methodology of the project has been the same for all participating countries.

As the first step a complete overview of the scientific sector within the last years was given. As background information the economic situation in the country, the demographic situation as well as international migration from the country was described on the basis of available statistical data. Statistics showed the dramatic decrease in production after 1989 and its profound impact on the science and development sector in terms of financing. In spite of the fact that the last two years are characterised by excellent macro-economic achievements in Slovakia, no positive changes for science development are to be seen. The figures unambiguously confirm deteriorating conditions for this sector. Within the last 6 years, science, research and development personnel dropped by approximately 50%. At the same time, the share of scientific personnel was almost stable. However, the age structure of scientists and university teachers became very unfavourable. Concerning the legal basis for science and research, there have been several legislative changes; nevertheless there is no long-term concept of transforming science and research.

The empirical research within the project consisted of three methodological approaches:

1. The collection of aggregate data by means of questionnaires addressed to all scientific institutions, universities and higher education institutions in the country.
2. The real migration survey
3. The potential migration survey

ad 1: For the directors' questionnaires we used the list of institutions of research, development and higher education published by the Ministry for Science and Education in 1993. The complete list included 540 institutes. We have sent out the questionnaires to all of them. After one reminder we have received 36.5% which means that 197 filled in the questionnaires, but the total number of those who answered was higher. The difference was caused by the fact that in the meantime some institutes or the research units had been eliminated. The directors' questionnaires provide aggregate data on real migration and also a very significant inside into the brain drain issue.

ad 2: To receive the real mobility data we wrote to 30 scientific institutes and universities in Bratislava. The personnel departments of the selected institutes filled in the questionnaires for scientific or university teaching staff who left the institute (broke the contract). A case-by-case approach has been applied for this survey; that means that for every individual employee who left the institute a separate questionnaire was filled in. The sample we have got consists of 939 cases.

The sample of institutions has been selected according to two quotas: type of the research institution and scientific domain. We have got a representative sample of the institutions in Bratislava. However, the generalisation of data, especially in terms of assessment of real migration, is limited. Nevertheless, the data provide a unique information about the structure of the flow of emigration, especially concerning the destination.

ad 3: The potential migration survey has been conducted in the same 30 institutions and universities which have been selected for the real migration survey. The questionnaires on potential migration have been completed by scientists and teaching staff employed at these institutions. The randomly selected sample has 932 respondents. Face-to-face interviews have been conducted by trained interviewers.

The questionnaire concentrates on conditions of scientific work, migration potential (external and internal), reasons to stay and to go, short term brain exchange and international scientific co-operation, value profile, demographic and social features of the respondents.

3. Empirical Findings

The phenomenon of brain drain has positive and negative aspects, advantages and disadvantages, costs and benefits. The scientists who travel and work abroad bring new experiences, know-how, contacts back to their country which enriches the national science sector. On the other hand, potential brain drain can easily turn into actual brain drain, brain drain in brain waste and brain loss. The project on brain drain in Slovakia reflects the whole ambiguity of the phenomenon.

Internal "brain migration" in the post-communist countries should be seen within the general context of economic transition and the substantive re-structuring of the labour market. Seen from the national economy's point of view, internal mobility has benefits in so far as the science sector is a source of qualified labour needed for successful transformation.

Our findings have shown that **the directors of scientific institutions** see the impact of external brain drain more positively than one would expect. According to several directors, the scientist keeps contacts to his/her mother institute, and therefore he/she is

very useful and functional for the home institute. In such cases we cannot speak about "brain waste". Some institutes are even happy when their employees work abroad. This is primarily due to financial reasons: since the scientist is employed elsewhere, the institute saves money for his/her income. Internal brain drain is seen much more negative partly because of its larger size, but mostly because of definitive brain waste. The situation seems to be more critical in universities and institutions of higher education. The situation in academies of science is stable, but outflow from universities continues.

The findings of the **real migration** survey proved that the number of internal migration are significantly higher than those of external migration. External migrants represent about one tenth of the total flow. The most frequent reason for leaving abroad is scientific work. Among the internal migrants the most preferred destination is the private sector. Scientists from biology, pharmacy and data processing represented more than average among external migrants. Mobility was at a peak at the beginning of the 90s. Since 1993 the situation has stabilized.

Whether potential brain drain becomes real brain drain or not depends on many factors. The **potential migration survey** has shown that over 25 % of scientist show a desire to go abroad. The majority of them consider to stay for 1-3 years. Our findings show that special importance in decision making processes is attached to better conditions of scientific work. It proves also that scientists are primarily interested in scientific work abroad. Therefore, brain drain might not mean brain loss, looking at the issue from the international point of view.

Potential external migrants judge the conditions of their scientific work in a very critical way. For them the most important values are those linked to the fundamental features of scientific work - professional satisfaction and availability of scientific information. Job security and financial support is less important. External migrants do not emphasize the values linked to social prestige and status in organization as much as their more stabilized colleagues.

The decisive factors for potential external migrants are the variables connected with mobility and flexibility: command of foreign languages, age, opinions on the advantages of scientific work abroad and the necessity of good scientific infrastructure. On the other hand, we can identify "factors of stabilization", that means, those factors which have a significant impact on the decision to stay in the country and in science; these are above all job security and status in the organization.

External migrants are more frequently convinced than their more stable colleagues that professional satisfaction and recognition is easier to achieve by doing scientific work in foreign institutions. Comparing the value profile of two groups of scientists - migrants and non-migrants - we can see that the hierarchy of values is very similar. Both groups put on top of this hierarchy the values linked to professional satisfaction, scientific independence and availability of scientific information. Statistically significant differences are to be found at the middle and lower level of the hierarchy of values. Potential migrants attach more importance to financial prosperity and career development; on the other hand job security is less important to them.

The desire to emigrate is evenly distributed between scientists who are satisfied with the economic situation and scientists who are less satisfied. Therefore the hypothesis that the subjective evaluation of the economic situation is the decisive factor for migration has to be questioned.

According to our findings, 17% of all scientists intend to leave their current employer. The most desired destination of potential internal migrants is the private sector: private agencies, consultant companies, etc. The proportion of potential external migrants is slightly lower than that of internal migrants. However, one should distinguish between the declared desire and the readiness to take concrete steps. While external mobility is the most desired option among the scientists, internal migration seems to be a real possibility. This has been proven by the real migration survey data.

Looking at the value profile of the categories internal migrants and non-migrants, it can be seen that the value hierarchy is very similar. Both groups put values connected with professional fulfillment, scientific independence and availability of scientific information on top of the list. However, the potential migrants attached more importance to financial prosperity and career development. Job security seems less important for them. While the value profiles of both groups proved to be very similar, there are notable differences between the groups in their views on how to reach these values. Values closely connected to scientific work are - according to the potential internal migrants - more probable to be achieved by moving to another field of activity in Slovakia, or by working in science abroad.

A considerable majority of potential internal migrants intend to leave for the private sector. This fact illustrates that the private segment of the labour market has been developed during the last few years, and offers an attractive alternative for the highly qualified professionals.

Our findings prove that the Slovak science sector has been opened during the last few years. Brain exchange, i.e. international scientific co-operation, has increased significantly. International co-operation on the basis of joint projects offers a positive alternative for East-West scientific communication. After years of restricted mobility, the right of free movement is a newly acquired right in new democracies. Whether the potential brain drain and expanding brain exchange becomes brain waste depends on the stabilization of the economy and the science sector. However, the Slovak scientists do not only want better financial prospects, but first of all want a better scientific structure. Better conditions for scientific work is one of the most decisive factors of potential external migration.

4. Main Topics to be discussed

1. The prevailing pattern among the potential migrants is to spend some time (up to three years) abroad and then come back and apply their skills and experiences in their home country. Our findings do not prove any correlation between involvement in international brain exchange and willingness to leave for longer periods. In other words, one could conclude that short-term stays abroad and involvement in international scientific co-operation do not increase the "danger" of external migration. On the contrary, participation in international scientific co-operation can, under certain circumstances, compensate some insufficiencies in national scientific infrastructures as well as lack of professional fulfillment.

2. The declared emigration motives of Slovak scientists are above all based on unsatisfactory conditions for scientific work - scientific infrastructure, availability of actual information, etc. Better conditions for scientific work play also a key role in the decision of external migrants. This fact should encourage authorities and leading officials from policy and science administrations to consider how to improve work conditions for scientists and universities' teaching staff,

even given the actual situation of budgetary shortages.

3. The probability to achieve financial prosperity by staying within the scientific sector in Slovakia is regarded as being very low (the lowest percentage among all 12 stimuli). Therefore the motivation to stay in science has to be supported by other values and aspirations. We called them factors of stabilization, which is above all job security, status within the organization and independence at work. It would be desirable to support the stability of scientific personnel also by better financial prospects and a better scientific infrastructure.

4. The findings indicate that the prestige of scientific work is very low. One could see that the communist legacy is still very deep rooted. Under the communist regime the intellectual work was not much appreciated and this attitude has not changed until now. The role of science, research and intellectual work in general should be strengthened significantly.

5. The development of brain exchange and the publication activities of Slovak scientists at international level can be classified as very progressive. However, it is desirable to encourage further international scientific co-operation in order to involve not only the leading experts and institutions, but the "main stream" as well.

6. The European Union encourages professional mobility within the member countries. It should be discussed how to enlarge the participation of participants from EU-associated countries in this process, especially for highly qualified labour.

7. At present, the state has lost its role as the only subject financing science and research activities in post-communist countries. More attention should be paid to activities of non-state non profit foundations, centres and institutions mainly engaged in research and development but also in educational work.

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

SLOVENIA

The real migration survey

The real migration survey in Slovenia was conducted with a questionnaire on real migration and a questionnaire for the directors of research institutions. 54 of the biggest scientific and university institutions with 14 or more employed scientists, and 3007 researchers were chosen for the sample of the survey. For the purpose of the study, an emigrant was defined as an M.A. or Ph.D. holder who was employed in one of the 54 research institutions, who left Slovenia in 1988-1994, who terminated employment in Slovenia and found paid work abroad. The paid work abroad could have been temporary or permanent.

In the period from 1988 to 1994 50 emigrants left 54 research institutions with 3007 employed scientists. 50 emigrants in seven years, or 1.7% of all employed scientists in Slovenian research institutions with 14 and more employed researchers, is a crude indicator of the brain drain phenomenon in Slovenia during the period 1988-1994. It is both too difficult and premature to evaluate this number with regard to the loss of talent and human capital of Slovenia. One can say that every emigration is a big loss for a small country, but on the other hand, one could also expect a much larger number of emigrants because of the serious economic crisis caused by the transition from a socialist to a market economy and by the loss of more than a quarter of the traditional markets of the Slovenian economy.

Emigrants' profile can be described by some basic descriptive statistical data. 58.0% of emigrants were from natural sciences, 20.0% from technical sciences, and 22.0% from social sciences. Regarding single disciplines, the biggest percentage of emigrants were from medicine (26.0%), followed by chemistry (12.0%), biology (8.0%), and economics (6.0%). More than half of the emigrants came from the universities (54.0%), followed by state research institutes (34.0%) and institutes of enterprises (12.0%).

The year with the highest number of emigrants was 1991 (24.0%). The second was 1990 (22.0%), and the third 1992 (18.0%). A little more than a third (36.0%) of emigrants went abroad during 1988-1990, 42.0% of them emigrated in the peak years of crisis, in 1991-1992, and 22.0% in the years 1993 and 1994.

Almost two thirds (64.0%) of Slovenian emigrants work in the science sector in their host country, 30.0% work outside the science sector and two emigrants left due to marriage. Practically all emigrants went into the developed countries. The USA accepted 40.0%, Canada 10.0%, Western Europe 34.0% and the other countries accepted 16.0% of Slovenian scientific emigration.

Motivation for migration can be studied from the viewpoint of a push or a pull hypothesis. Most of the push factors in the case of brain drain migration are based on low salaries and standard of living, an unfavourable situation in the science sector and some other factors connected to scientific and personal promotion of potential emigrants. Pull factors on the other hand stimulate scientists from less developed countries to emigrate to developed countries with much larger salaries and standard of living, a much better situation of the science sector and much better prospects for professional reward and promotion.

From the viewpoint of the outlined theoretical framework, Slovenia is a less developed country from which a considerable number of scientists emigrated during 1988-1994. They emigrated mostly to more developed Western Europe and the USA. Generally speaking, our data confirm the outlined theoretical framework. However, on the basis of data collected in the real migration survey, it would be hard to confirm real and heavy brain drain from Slovenia.

One could even speculate why brain drain from Slovenia, in the period of evident political, economic and social crisis, has not been much larger. However, the crisis definitely was connected to emigration. The peak years of crisis, 1990-1992, were at the same time peak years of emigration. Two thirds of emigration took place in these three years. Most of Slovenian emigrants are younger Ph. D. holders without any administrative position in their domestic research institute.

Emigrants are, in spite of continued relations and even co-operation with their home institutions, a considerable loss for Slovenia. Most of them are talented researchers, because almost two thirds of them have been found working in foreign research institutions. However, it should be stressed that the directors of domestic institutions consider the loss due to emigration for the research programmes of their institutes as not being important or even as being negligible. There is some evidence that scientists who had decided to emigrate simply could not find their proper place in the programmes of domestic institutions.

Less developed countries face losses and gains from brain drain. Slovenian data show that some emigration is temporary. It means that temporary emigrants can bring foreign experience to their home country. On the other hand, even permanent emigrants can help their country of origin. They are connecting points for the specialization of younger scientists from domestic countries and possible collaborators for joint research projects between institutions from emigration and immigration countries.

Obviously, the solution for the brain drain problem does not lie in restrictive measures and prohibition of migration, but in the search of finding a way from brain drain to brain exchange between different countries. Modern globalization processes in the science sector are at least as important as globalization in production, world economy and politics. Brain exchange is the only process which can lead to leveling out different levels of development of science and higher education in different countries. Central and Eastern European countries, including Slovenia in particular, need brain

exchange with the rest of the world which was prevented during 1940 to the beginning of the 1990s.

The potential emigration survey

1012 scientists with master's or doctor's degrees were surveyed (29% of the "population") on the basis of random sampling. 64% of them answered, which accounts for almost 1/5 (18%) of the "population". Since many characteristics of the structure of respondents to the questionnaire are very similar to those of the structure of the whole population of scientists in Slovenia and since random sampling was used, the conclusions on the basis of the survey are of great importance for government policy with regard to the science sector in Slovenia.

RESULTS

Some main characteristics of scientists surveyed

57% of the surveyed persons had a doctor's degree (higher share than in the region). Almost three quarters of scientists (72%) were men (a much higher percentage than in the "region" - 64%). The break-down by scientific domains was the following : 47% from natural, medical and biotechnical sciences (higher share than in the region - other two fields - lower share), 29% from technical and 23% from social sciences and humanities. The majority of scientists (54%) were employed in institutions of higher education (more than in the "region"). 40% of the surveyed scientists have worked in the field of science up to 10 years (region - 30%), and 60% of them for a longer period (region - 70%); 38% of the surveyed persons have a leading position in their institution (region - 35 %)

Potential emigration

The extent of the phenomenon - The break-down of the surveyed persons by the probability of going abroad for more than 1 year is the following: determined migrants 7%, undetermined 69%, non-migrants 24% (a structure similar to that of 7300 surveyed persons in all 10 countries: 10%, 68%, 22%). Most potential emigrants are undetermined. The duration of the planned emigration, the structure of emigrants and the size of the long-term emigration is as follows:

- short-term migrants (1-3 years) : 75% (determined 20%, undetermined 55%) - lower share than in the region (79%), or more precisely a lower share if compared to all other countries except Bulgaria;
- medium-term migrants (4-5 years) : 10% (determined 1%, undetermined 9%) - similar share than in the region;
- long-term (more than 6 years) : 15% (determined 6%, undetermined 9%) - higher than in all other countries except Bulgaria.

Factors:

1. Factors leading to emigration for more than 1 year (determined, undetermined, non-migrants) :
 - Personal characteristics of professional standing - education (researchers with M.A. are more inclined to go).
 - Demographic factors - age (young, especially those of less than 30 years, are more inclined to go),

marital status (single and divorced are more inclined to go), number of children under of 18; among the above-mentioned factors age has the strongest influence.

Professional activity : being abroad after 1990 for postgraduate, doctoral study, international conferences, short training, joint projects, research networks. Economic situation - the change of the financial situation during the last few years, the share of a scientist's salary in family income, the current financial situation; the first of the above-mentioned factors has the strongest influence.

Evaluation of work conditions - no influence (except the availability of required professional information); a similar observation as in the majority of other countries under investigation.

Hierarchy of values - career development, financial prosperity, status in the organisation of employment, good research infrastructure, modern way of life, professional satisfaction; all these values are more important for determined migrants than for undetermined migrants and determined non-migrants.

2. Factors for abstaining from emigration: separation from the family (the most important factor, at the same time the strongest influence among the countries observed), homesickness, health problems, non-recognition of academic degrees and diplomas, administrative and legal problems with local authorities (abroad); for determined migrants the first three factors are much less, and the last two more important than for less probable migrants.
3. Factors influencing the duration of planned emigration: the social status of scientists, the purpose of emigration, changes of the financial situation of the scientist's family in the course of the last few years, current financial situation of the scientist's family, the dependence of the scientist's family income on his/her salary, duration of being abroad after 1990 for the reason of postgraduate study and participation in conferences, employment (the scientists from institutions of higher education have the lowest propensity to all types of emigration regarding the duration; a higher propensity for long-term emigration is typical for scientists from non-state research institutes and from other institutions - firms, hospitals, etc.), scientific field (longer emigration - more than 10 years - the highest propensity for researchers from technical sciences; slightly shorter emigration - 6-10 years - the highest propensity for researchers from natural, medical and biotechnical sciences; the shortest emigration - 1-3 years - the highest propensity for researchers from social sciences and humanities).

Potential internal mobility in 1995

The extent of potential mobility within the country in the observed year : 12% migrants, 35% undetermined migrants, 54% non-migrants. The extent of potential internal migration in 1995 was higher than average in the region of 10 observed countries (it was higher only in the Czech and Slovak Republics). *The factors of internal migration (in 1995)* :

Personal characteristics of professional standing - education (stronger influence than for external migration; scientists with M.A. are more inclined to change jobs),

employment (the highest propensity for those who work in non-state institutions), work experience in science (the highest propensity for those with 1-5 years of experience), position in the institution.

Demographic factors - age (one of the most important factors; young - especially those of less than 40 years are more inclined to change jobs), marital status (single and divorced are more inclined to change jobs).

Professional activity: published papers from international conferences, being abroad after 1990 because of a permanent part-time job (duration).

Economic situation - standard concerning their flats, current financial situation of the family, changes during the last few years, additional work, own private business in scientific and non-scientific fields, and contractual scientific services.

Evaluation of work conditions (all conditions included in the questionnaire): participation in the selection of team members, dealing with tasks for less qualified fellows, interest of a supervisor in the problems, access to professional information, technical facilities; the last one has the strongest influence.

Hierarchy of values - position in the organization, prestige in society, financial prosperity, recognition by colleagues; the probability of achievement of particular values in different circumstances in the next 5 years - all 12 values included in the questionnaire (the following values exert the strongest influence : independence in work, career development, position in the organization of employment).

The demand for scientific output in the country from different types of institutions: state, non-profit organisations.

Potential brain loss (internal, external)

The extent of potential brain loss: Internal brain loss:

1. In the observed year: among potential mobile scientists about one third planned to leave the science sector (less than the average in the region - about 50%); among those who planned to leave it, the probability of returning to the science sector was the highest among those from natural sciences and the lowest among those from social sciences and humanities.
2. In the case of finding a better paid job in the country, 43% will leave the science sector (region -39%).

External brain loss: 7% of potential emigrants plan to work outside science (region -4%) - among determined migrants even 10% (undetermined 6%); in the case of finding a better paid job abroad 23% of surveyed persons will leave the science sector (region -29%).

Overall *loyalty to science* is higher than average in the region: 63 % of scientists intend to work in science for "ever" (region -50%).

Some factors of potential brain loss: education (scientists with master's degrees are more inclined to

leave the science sector than those with doctor's degrees), broader scientific field (the propensity to external and internal brain drain is the highest among those from technical sciences and the lowest among those from social sciences and humanities), employment (the probability of leaving the science sector is the highest among scientists in non-state institutions and other institutions - firms, hospitals, etc.), work experience in the science sector and age (the "loyalty" to science is in inverse proportion to work experience and age); sex (men are more inclined to leave a science career than women).

CONCLUSIONS AND RECOMMENDATIONS

Potential external and internal mobility of Slovenian scientists is high in absolute and in relative terms (in comparison to the other 9 observed countries) and, regarding the structure of this mobility/migration, the potential brain loss is also considerable. In both cases the potential brain loss is the highest among scientists outside the higher education system and state research institutes, and on the other hand it is the highest among scientists from technical sciences (and the lowest among those from social sciences and humanities). Slovenia has a lower share of scientist from technical sciences compared to the average in other countries observed (on the basis of the survey), and the interest among the young for these subjects is declining whereas it is increasing for social sciences. For this reason one important recommendation is to improve the situation in this field of science. Different factors influence the potential external and internal mobility and brain drain. One of the main reasons for the potential internal mobility and potential internal brain drain is the economic situation of scientists and the unstable funding of scientific work. Since the internal brain drain was quite intense in the early 90s (statistical data) and the survey on potential migration shows the possibility of the continuation of this trend (the lowest in the higher education sector) one policy recommendation is to stabilize funding of scientific work outside the higher education sector. Increasing the share of women in the science sector could also be one of the policy recommendations, since the share of women is low (lower than in the majority of the observed countries), and on the other hand women in Slovenia are more "loyal" to the science sector than men. Consequently, three important questions to deal with science policy could be: technical sciences, scientists outside the higher education system, gender.

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Public administration and public services affected more than one eighth of those who left their jobs in the science sector. Those who changed jobs within a broadly defined research sector, including consulting, were mostly married, men, 35-38 years old, with Ph.D. or Master's degrees, working in engineering, technical and chemical sciences, biology or in economics, with 5-10 and 15-20 years of work experience, mostly in one place of employment. More than 20% of them did some post-diploma studies abroad for more than 1 month.

Among those who left science jobs for public administration also the major part were men, married, 39-43 years old, mostly with Master's degrees, working in engineering, economics and other technical sciences, with 5-10 years of work experience.

Internal migration from scientific institutions to other jobs is different by regions. Major changes were registered only in Warsaw. Poznan and Lublin registered much lower levels of mobility, and then mostly to consulting firms.

B. International migration

During 1988-1994, 15 per cent of all scientists who left jobs in their institutes have emigrated abroad. The United States received most of the emigrants (44.0%), followed by Germany (10%) and then by France, the United Kingdom and Canada (5% each). Work in the field of science is a reported dominant declared reason for emigration (65.5% of the overall sample).

The questionnaire did not provide any information on whether these claims have been actually realised in post-emigration employment of migrants. If the migrants actually worked abroad in science, this would imply a steady improvement of the rate of success of Polish scholars in continuing scientific work in post-emigration careers. The Warsaw University's team reported earlier rates of 22.7 per cent for 1981-1991 emigrants, and of 42.2 per cent for 1992-1993 emigrants⁴.

A relatively high success rate of professional attainment in post-emigration career is also reported in the Polish PECO/COST research project on employment careers of Polish graduates in Sweden. The Majority of Polish graduates was found able to claim full success in gaining a satisfactory position in terms of the job performed and its remuneration⁵.

⁴ Bohdan Jalowicki, et al op.cit., p. 139

⁵ Adam Jozefowicz, Polish graduates. Employment careers at Home and in Sweden. CEIFO, Stockholm. 1996, p. 87

Engineering and mechanics dominated the disciplines of the emigrants of the years 1988-1994, with biology, chemical science, other technical sciences, physics and medicine following on. Most emigrants hold Ph. Degrees (58.9%), have a relatively long work experience in the science sector; they were mostly in the 34-39 age group and as a group were younger than those migrants who preferred domestic employment opportunities in research or in business consulting. It is significant that less than half of the emigrants (45.8%) participated earlier in post-diploma studies abroad.

A noticeable decrease in the volume of international migration during the transition period did not concern scientists whose declared reason for leaving the domestic institute was to work in science abroad. Throughout the whole period covered by the survey (1988-1994), a steady outflow of this category of migrants continued, suggesting that well established personal contacts and professional international exchanges existed. Among the three university centres, Warsaw registered the highest rate of external migration while Poznan and Lublin experienced somewhat lower rates of foreign drain. In comparison with pre-reform regional differences of external migration rates mentioned earlier, the present data suggest a more uniform attitude towards international migration.

IV. Potential emigration of scientists

Low salaries for scientists in Poland do not meet expectations raised by the 1989 political changes, and leads to ambivalent sentiments and attitudes towards emigration. These mixed feelings can be observed in a very low percentage of determined migrants, but a widespread willingness to temporarily migrate. A large majority of scientists would accept a research or fellowship offer involving leaving the country for a period of more than a year. This phenomenon cannot be taken as an indicator of potential migration. The latter is determined by the willingness of the recipient country to accept immigrants on the one hand, and by potential emigrants taking appropriate actions to emigrate on the other hand. Such action was taken by only 2.1% of all scientists; and they constitute the group of determined migrants. Nearly a quarter of respondents may be categorized as undetermined migrants.

Planned duration of a foreign visit usually falls in the one-to-three years range, though there are also declarations of willingness to leave permanently. The most frequently named recipient country is the USA (almost twice as often as any most frequently named European country), followed by Germany and the UK

The majority of individuals plan to continue working in science. For them, the prime pro-emigration factor is the gap between the prospects of the development of science and scientists' careers in Poland and abroad. The objectives most esteemed by the scientists are the following: professional satisfaction, availability of scientific information and good research infrastructure. Financial prosperity is seen to be most easily achieved by continuing a scientific career abroad. These goals would be the most difficult to achieve by

continuing research work in Poland. The same values at the top of the scale are maintained by determined and undetermined migrants. Determined migrants valued more highly financial prosperity and stressed greater opportunities for rapid career development abroad than other respondents.

Scholars working in natural and technical engineering sciences are more inclined to cherish pro-emigration sentiments than other scientists.

Young age is strongly linked to pro-emigration attitudes as well as an unsatisfactory economic status and opportunities for earning additional income within the profession. Both pro-emigration and non-migration attitudes were observed with individuals who participated in training or Ph.D. programmes abroad. The presence or absence of publications differentiates the population only with respect to the duration of migration. Those who have not published anything are more willing to take up jobs outside science and accept offers of training abroad.

Potential emigrants willing to take up jobs outside science are below 30, have Master's degrees, work experience up to 10 years, attach great importance to financial prosperity and are working in the engineering or technical sciences.

Potential internal migration - internal mobility

9.2 % of all scientists plan to change jobs. The majority of them are planning to continue working in science in private or state institutions. The remainder expect to move to self-employment or to private business sectors outside science.

More likely to leave their jobs are those with lower academic degrees, shorter work experience, younger age and lower professional activity. Most of them do not have any additional sources of income from publications or other services.

One aspect of the internal migration of scientists {professional mobility) is a tendency to take up additional, full-time jobs, often outside science; to enter private business as entrepreneur or employee and/or to become a member of the board of directors of business companies. Internal migration cannot therefore be categorized as a brain loss to the society, since at present it may rather represent a redistribution of society's high skills to activities and careers governed by short-term market preferences. However, it increases the generation gap in the science sector, and weakens its impact on the long-term development potential of the country.

V. Conclusions

1. Transition to market based economy and the opening up to international exchanges has

reduced the rate of emigration of scientist but the outflow of young, well educated scholars continues. The present foreign drain is widening the generation gap in the country's stock of scientists generated by the pre-reform emigration of the 1980s. Poland together with the Czech Republic, Hungary and Estonia is in a group characterized by a high percentage of scientists leaving academic institutions and a high percentage of individuals able to find jobs in the science sector abroad.

Potential emigrants, however, tend more and more to take into consideration a broader range of factors in making their migration-related decisions and better scrutinize opportunities for their scholarly career development abroad.

The relatively large percentage of undetermined emigrants (nearly one quarter) rather indicates raised expectations and post-reform frustrations are higher than an eminent supply of Polish science personnel on the international labour market. It is the demand side of that market that determines the actual magnitude of migration.

2. At present the greatest outflow of scientists from state institutes is to profit-oriented domestic research institutions, consulting firms and to branches of foreign companies offering non-scientific jobs with much more attractive salaries and other material rewards than those offered by most of the public, non-profit oriented research institutes and public institutions. Opening up to international exchanges and the transition to a market based economy has created a dual job market and new career opportunities for some highly skilled scientific personnel. Low pay in the public science sector also led scientists to holding a number of jobs; a fact which adversely affects the professional performance of scientists and the science sector.

4. Migration of scientists cannot be eliminated. Differences will always exist between countries with respect to opportunities for the development of science and scientists' careers. External migration to permanently stay abroad brings direct and indirect losses for the countries of origin. Under the communist regime the science sector and working and pay conditions for scientists used to be over regulated. The scientists were largely isolated from the main international scientific and technological development centers and the society at large suffered losses.

Increased international exchanges (international professional mobility), including temporary migration, may have some positive consequences for the Eastern countries though some short-term brain drain may be involved in the process.

Item	Emigrants, 1988- 1994	Potential external emigrants with intended stay abroad of					Non- migrants
		forever	more than 10 years	6-10 years	4-5 years	1-3 years	
Academic degree :							
Master	34.7	57.1	20.0	40.0	61.5	44.4	52.5
PhD	58.9	42.9	70.0	60.0	30.8	38.0	34.9
Higher PhD	6.4	-	-	-	7.7	17.6	12.6
Scientific fields :							
Natural sciences	48.5	57.1	20.0	20.0	46.1	60.4	37.7
Engineer-technical	43.1	28.6	40.0	20.0	46.1	21.6	39.1
Social sciences	8.4	14.3	40.0	60.0	7.8	18.0	23.2
Disciplines :							
Mathematics	-	14.3	-	20.0	7.7	2.0	1.2
Chemistry	11.9	14.3	20.0	-	15.4	18.8	8.2
Biology	19.3	14.3	-	-	5.4	20.8	8.1
Medicine	5.0	-	-	-	-	6.3	5.0
Agronomy	1.5	14.3	-	-	-	3.5	2.2
Mech. Engin. & Mech.	21.3	14.3	-	-	7.7	7.8	17.0
Electrotechnics	4.5	-	-	-	7.7	11.4	5.1
Metallurgy	-	-	20.0	-	-	1.2	3.1
Automation & Dat.	3.0	-	20.0	20.0	15.4	3.1	5.7
Ecology & Environment	2.5	-	-	-	-	2.4	1.9
Economics	5.0	-	40.0	40.0	7.7	9.0	10.6
Sociology & Politology	3.0	14.3	-	20.0	-	3.9	6.5
Others Natural	10.8	-	-	-	7.6	19.0	13.0
Others Technical	11.8	14.3	-	-	15.3	6.7	6.3
Others Social	0.4	-	-	-	-	5.1	6.1
Scientific units:							
Academy of Sciences	54.5	42.9	40.0	40.0	46.2	41.2	39.2
University	30.2	42.9	40.0	60.0	46.2	46.2	32.1
State research institutions	15.3	14.2	20.0	-	7.6	11.8	27.6
Others	-	-	-	-	-	0.8	1.1
Work experience as a scientist							
:	-	28.6	-	-	23.1	7.1	1.1
Up to 1 year	14.9	-	-	20.0	15.4	23.5	18.6
1 - 5 years	25.7	28.6	-	20.0	15.4	18.8	15.5
6 - 10 years	27.7	14.2	20.0	-	7.7	13.3	14.8
11 - 15 years	31.7	28.6	20.0	60	38.4	37.3	50.0
More than 15 years							
Position in academic hierarchy							
*	-	-	-	-	-	3.9	2.6
Director, dean, deputy	1.5	-	-	-	7.7	4.7	7.4
Head of department	5.0	-	-	-	-	8.3	8.1
Head of sector	44.6	14.3	20.0	-	15.4	7.5	32.1
Others	48.9	85.7	80.0	100.0	76.9	75.6	49.9
No specific position							
Participation in post-diploma study abroad:							
YES	45.8	-	-	-	-	9.4	57.4
NO	54.2	100.0	100.0	100.0	100.0	90.6	42.6
Sex:							
Male	65.3	42.9	40.0	60.0	92.3	68.4	65.4
Female	34.7	57.1	60.0	40.0	7.7	31.6	34.6
Marital status:							
Single	20.8	42.9	40.0	40.0	38.5	25.9	18.8
Married	74.7	57.1	60.0	60.0	61.5	67.8	76.8
Divorced	4.5	-	-	-	-	4.7	3.3
Widower/Widow	-	-	-	-	-	1.6	1.1

Age :							
Up to 51 years	3.0	28.6	-	20.0	30.8	29.5	11.6
31 -40 years	45.3	28.6	25.0	40.0	15.4	28.7	18.3
41 -50 years	39.8	28.6	50.0	40.0	38.4	28.3	32.8
More than 50 years	11.9	14.2	25.0	-	15.4	13.8	37.3

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**MIGRATION
EUROPE'S INTEGRATION AND
THE LABOUR FORCE
BRAIN DRAIN**

ROMANIA

The report has three parts:

Part one, General data; author Constantin Ciutacu, Institute of National Economy, Romanian Academy of Science loan

Part two, Real migration of experts from education and research; author vlarginean, Institute for the Quality of Life, Romanian Academy of Science

Part three, potential internal and foreign migration; authors Oscar Hoffman and Ian Glodeanu, Institute of Sociology, Romanian Academy of Science

The whole report is briefly summarized below.

Part one of the paper includes an analysis of the demographic and economic context of scientific research in Romania. Data are presented on the evolution of demographic phenomena, the transition to market economy, the occupation of the labour force, unemployment, emigration, as well as on specific characteristics of scientific results such as institutes and centres of scientific research, profiles and public or private status, staff, financing, results of scientific research, etc.

Part two of the paper presents the results of the investigations conducted in 34 institutions (24 institutes and 10 universities) on the subject of real migration. During 1988-1994, professional mobility represented 15.8% of the total number of experts existing at the beginning of the reference period. Of total emigration between 1988-1994, only 20% was emigration to foreign countries. The highest numbers of migration were recorded in industrial engineering, construction, communications technologies, medicine, biology, mathematics.

Migration of experts is enhanced by post communist transition, either due to the need to reorganize activities and to increase or decrease the number of personnel, or due to changes in the general social environment. Some institutes have consolidated their situation by employing new scientists which they needed, others have lost an important part of their human capital. Judged from a scientific perspective, the migration of experts towards sectors not related to science is considered a loss (brain loss), especially if experts leave sectors, where they are at need. However, if the need for experts in other areas of social life is considered, the perception of brain loss is regarded differently. We have observed that not only the economic development in Romania, but also a range of unfavorable conditions for specific activities determined and still determine some people to leave the research domain. The consequences are difficult to assess, but it is certain that the capacity of scientific creativity will decrease. The process of renewing the age structures became more difficult. In many research institutes, even in universities, the proportion of young people, although higher than in 1989, is still low.

Furthermore, a large segment of employees are over 50, the middle-aged generation is diminished. Under the difficult conditions of transition, part of the experts emigrated to another country temporarily.

Part three deals with the analysis of the potential migration of experts. The investigation was conducted on the basis of a sample of 1025 persons from 30 research institutes and higher education in the main fields of science, located in major I scientific and educational centres of Romania.

The main conclusions and trends of the field investigation are:

1. After 1989, research activities opened towards international scientific cooperation. Researchers participated in common research projects, scientific meetings; they went abroad for documentation and scholarships. Fewer direct contacts were recorded lately, which is mainly due to extra-professional reasons (lack of financial support).

2. After a period of strong emigration (1990-1992), a trend towards stability was noticed with lower rates of both permanent and potential emigration.

3. The motives behind potential migration are first of all research conditions (laboratories, modern equipment, possibilities of information and documentation) and not economic reasons. No doubt, economic factors also are important, but they are not the most important ones. The connection between potential emigration and the type of activity the researchers want to perform in the host country shows that most of them still want to work in the scientific field.

4. The factors favoring potential migration are: a. age: younger people are more inclined to migrate than older people; b. seniority: senior researchers or teachers are more stable than those with less work experience; c. place of work: most of the potential migrants come from state research institutes which do not belong to any Academy, while the specialists from the higher education sector are more stable; d. scientific field: most emigrants come from engineering and technology domains, while only few of them come from social sciences and humanities; e. subjective economic status: most of the potential emigrants judge their financial situation to be worse than before 1989, and they have no hope for a better economic situation during the next two years.

5. The geographic distribution of host countries shows a concentration on a small number of countries. Most of the potential emigrants show a preference for EU countries. Almost two thirds of emigrants want to go to France, the UK, Germany or Italy. The strongest reasons to opt for a particular country are: better research conditions, knowledge of the language and a potentially high standard of living and income.

6. The main difficulties encountered for training periods abroad are: the lack of

financial support and difficulties to obtain the entry visa.