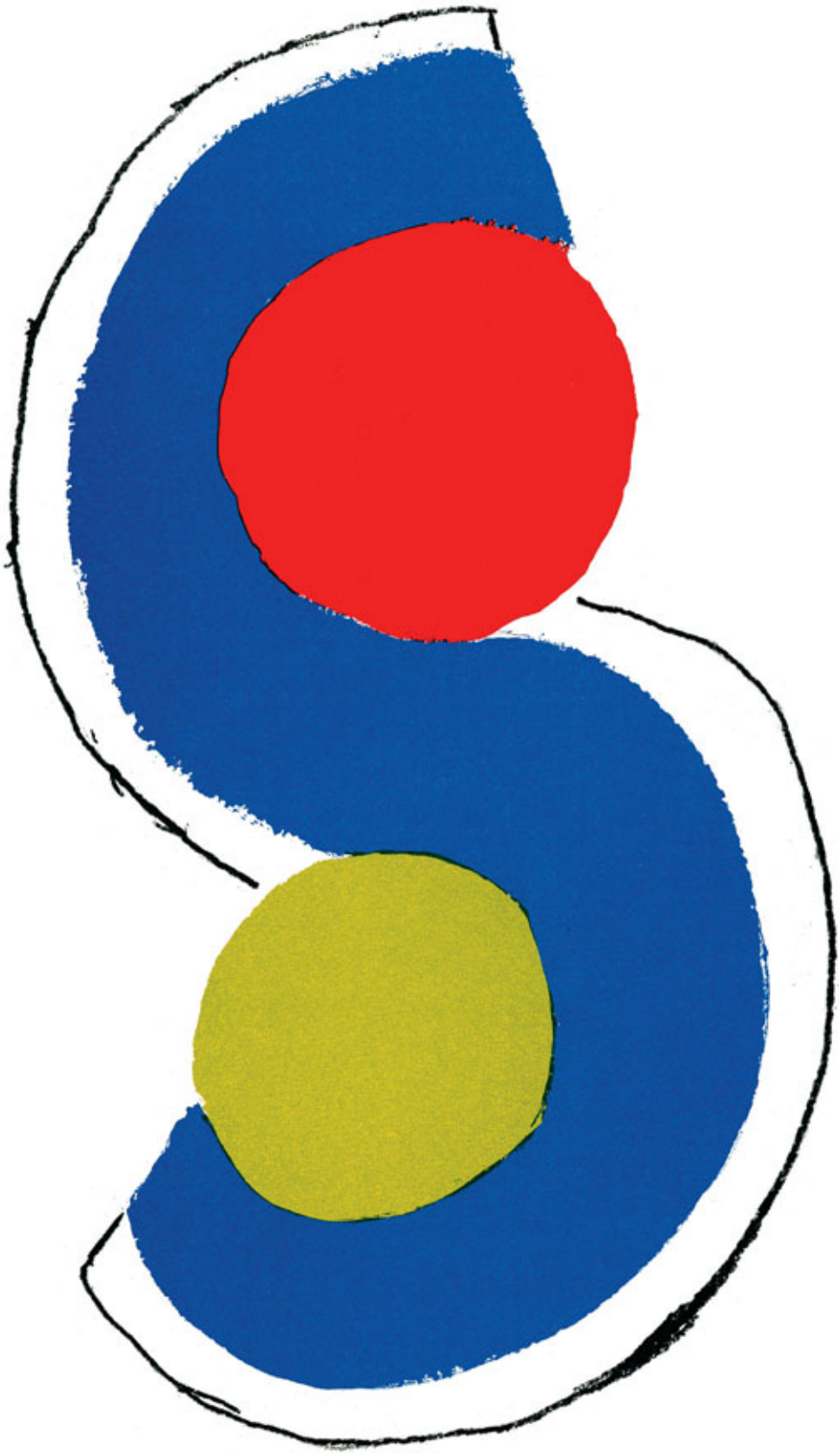

2.

Funding without freedom, freedom without funding

Higher Education and Research & Development sectors in the Enwise countries

Introduction

As it was the case for women's movements, a discourse building upon **continuity vs. discontinuity** can be used to characterise the changes over times of Higher Education (HE) and Research & Development (R&D) sectors in the Enwise countries. This chapter aims to provide an understanding about the current state-of-art of those sectors on the basis of a comparative analysis between the various Enwise countries.

Joseph Ben-David's concept (Ben-David, 1971) of the ***science centre*** and the ***science periphery*** is assumed as a relevant methodological reference point for this analysis. According to this conception, the country, which plays the role of *science centre,* provides (for a certain period of time) the norms, patterns and ideals of the scientific activity, including the models for HE and R&D, the structures of organisation and management of science, i.e. the *science policy*. Whereas the countries of the so-called *science periphery* copy the science values, models and structures provided by the *science centre* or at least imitate them. The countries of the *science periphery* transfer and adapt the *science centre*'s models to their national backgrounds. During the 19th century, France played the role of *science centre* for **part** of the Enwise countries, replaced by Germany at the beginning of 20th century. After World War II (WW II), the former USSR played, for about fifty years, the role of *science centre* for **the majority** of the Enwise countries.

The structure of the chapter envisages three periods, with a special focus on the transformations of HE and R&D sectors in the Enwise countries from the communist period to the transitional period, as well as on the transitional period itself.

1. Pre-communist times (until World War II)
2. Communist period (World War II - 1989)
3. Transitional period (1990 - 1998/9)

No special focus is set up on the impact of these transformations on women scientists of the Enwise countries because most members of the Enwise Expert Group explicitly claim that these affected both women and men scientists *in an equal way*. Nevertheless, the expected scenario set up by the newly shaped HE and R&D sectors of the Enwise countries is suggestive of a pessimistic expectation about the future prospects of women in science in these countries.

Pre-communist times (until World War II)

The institution building of modern universities started at the beginning of the 19th century and was based on the diversity of theoretical conceptions and visions about the supposed mission and organisational structure of the new type of higher education institution. Among them was the German ideal of a **modern university**[1]. According to this ideal, the key features of the modern university were to be the unity of teaching and research and the principle of university autonomy.

During these pre-communist times, R&D activities were carried out at the already established modern universities in the majority of Enwise countries. In parallel with the university institution building, some Enwise

1. It was elaborated at the beginning of the 19th century by a group of eminent German philosophers and thinkers, such as Fr. Schelling, W v. Humboldt, J. Fichte, Fr. Schleiermacher and later embedded in the establishment of the Berlin University (1809).

countries also founded their National Academies of Sciences (NAS) according to the modern Western model, i.e. as associations of eminent scientists. Some distinguished university professors were at the same time fellows of the NAS and the two institutions worked in synergy and enjoyed autonomy.

Communist period (World War II – 1989)

The issue of communist past is a very sensitive one, because the communist regime affected the daily life of at least three generations of people, including the lives of women and men in science. In the course of time, the regime itself changed. The regime was differentiated not *only in terms of time, but also in terms of location.* From this point of view, the Enwise countries had a common *but not identical* communist past. Therefore, a particular mixture of positive and negative experiences vary across the Enwise countries, as well as across the different generations of women and men scientists, the youngest ones being the most indifferent to the issue. The effect of the situation, as it is, is that every attempt to draw a common picture of the communist past faces a concern of over-generalisation and sometimes of overstatement. On the larger scale of Enwise countries' public opinions, the communist past still bears subtle meanings, which have led to a certain societal frustration. This frustration stems from the existing diversity of assessment of this communist past, based on different personal experiences. It happens that the experience of some people may contradict that of others. During the Enwise workshop of April 2003 on *Young Scientists*, a young Slovenian computer scientist[2] stated that in his opinion "*the main reason for scientists to leave their home country is not money, but that they are fed up with local frustration and the complexities of the environment*". Nowadays, facing the said problem, social and humanity scholars are re-thinking the issue of the communist past in terms of a *dynamic process* rather than in terms of a *static state* in order to validate every particular positive and negative experience in an inclusive way.

After World War II (WWII), most of the Enwise countries adopted the *Soviet model* of HE and R&D system. This constituted the first dramatic discontinuity with their national cultural traditions and institution building. HE and R&D sectors in the Enwise countries were completely transformed and lost their institutional autonomy. It meant firstly the introduction of a division of the HE and the R&D sectors. The new mission of the universities and equivalent HE institutions mainly became to teach and, to a lesser degree, to perform research. The NAS of the Enwise countries were re-organised in accordance with the organisational structure of the USSR Academy of Sciences. Thus, the structure of the Academies of Sciences' research institutes became the major organisation form of the R&D sector in these countries.

Secondly, it meant the implementation of a strict governmental planning and control on both sectors. The communist party's authorities laid down directives regarding the formation of state S&T policy. HE and R&D sectors were subject to strong ideological pressure, including the promotion and career building of research and teaching personnel.

2. See Enwise workshop on *Young Scientists* at the end of Chapter 4.

Last but not least, the promising human resource potential of the Enwise countries was offered the opportunity for graduate and postgraduate studies at the *science centre* (USSR). The research institutes of the Enwise countries also used to purchase equipment from the Soviet Union.
For the purposes of this analysis only and in order to facilitate the understanding of communist R&D functioning, the Enwise countries have been clustered into three groups[3]:

- **Bulgaria**, the **Czech** and the **Slovak Republics** (at the time jointly part of Czechoslovakia), **Hungary** and **Poland**[4] during the communist period, these countries were independent nation states under the influence of USSR and part of the so-called Soviet Block. According to J. Ben-David's concept, these countries were part of the *science periphery.* The majority of these countries had already established their NAS during the 19th century. Additionally, these countries had already built democratic societies and market-oriented economies, during the first half of the 20th century.
- The three **Baltic States**: **Estonia**, **Latvia** and **Lithuania**: after WWII, these three countries became, for the next fifty years, part of USSR and thus part of the *science centre.* This fact is important in that, in practice, it shifts the focus on the attempt to elucidate their R&D sectors during the communist time, as well as during the transitional period. In both periods, the three Baltic States followed a particular path compared to the countries from the first group. The specificity of their R&D reforms cannot be understood without keeping in mind the noted differences. The Baltic countries did not found their NAS during the 19th century. This fact is also relevant when attempting to understand the specificity of their reforms of R&D sector.

3. Reasons for creating these three clusters are given under each group of countries.
4. and the German Democratic Republic.

German Democratic Republic (GDR) / Deutsche Demokratische Republik (DDR)
(1949 - 1990)

Area	108 333 km²
Capital city	Berlin
Population	16.4 million inhabitants (1989)
Religion	Protestants (31 %), Roman Catholics (7 %), 1% other religion/church, without religion (61 %)
Form of government	Socialist Republic
Currency	1 Mark (ost-) = 100 Pfennige

Source: Statistisches Amt der DDR (1990): Statistisches Jahrbuch der DDR 1990. Rudolf Haufe Verlag: Berlin in Burkhardt, 2003.

Socialist Federal Republic of Yugoslavia (SFRY)
(Data as of December 1990)

Area	255 804 km²
Capital city	Belgrade
Population	23.5 million inhabitants
Ethnic profile (1981 census)	Serbs, Croats, Muslims, Slavs, Slovenes, Macedonians, and Montenegrins (over 80 %) - Albanians (7.7 %) and Hungarians (1.9 %)
Religion (1990)	Roman Catholics (30 %), Serbian & Macedonian Orthodox (50 %), Muslims (9 %), Protestants (1 %), others (10 %)
Form of government	Socialist Federal Republic
Currency (January 1991)	US$1 = Dinar (YD10.50)

Source: Blagojević, 2003.

- **Slovenia** and **Romania**: during the communist period, Slovenia was part of the Socialist Federal Republic of Yugoslavia (SFRY) and Romania was an independent nation state. SFRY was under the influence of the USSR, **but not** part of the Soviet Block, whereas Romania was under the influence of the USSR **and** part of the Soviet Block. Unlike the other Enwise countries, the political regimes of SFRY and Romania during the communist period demonstrated a kind of ***separatist inclination***. The communist regime was assessed as too liberal (according to its own standards for freedom) in SFRY and as too authoritarian in Romania (again according to its own standards for freedom). In any case, SFRY and Romania resisted the adoption of the *Soviet model* of R&D, as well as that of HE. This fact also gives a clue for a better understanding of the HE and R&D sectors of Romania and Slovenia, both of which adopted during this period a mixture of Western and Soviet science *models.*

The strategic aim of these countries of the so-called *Soviet Block* was **to win the Cold War competition** under the leadership of USSR. Science and scientists from the Enwise countries had a high responsibility for the implementation of the instrumental **rationality of socialist society**. From this point of view, the communist media succeeded in building a positive public image of science in society. Scientists were no longer seen as bearers of the national cultural traditions and values (as in the previous pre-communist times), but as builders of this rational socialist society. During this period, the profession of science enjoyed relative prestige.

In 1949, the Soviet Union, Bulgaria, Czechoslovakia, Hungary, Poland and Romania founded the so-called "*Council for Mutual Economic Assistance*", known as **Comecon**[5]. The underlying idea of Comecon was a common planning, mutual aid and division of work, including intellectual work. Comecon included a *Committee for co-operation in R&D* of the Enwise countries. However, with over 70% of Comecon's population, the Soviet Union dominated the organisation, especially since it was the principal source of the group's energy and raw materials. In practice Comecon was the *umbrella,* under which the entire process of research and education was *planned* and *controlled* by the USSR. During this period, the majority of the Enwise countries had been assigned specific R&D profiles by Comecon.

5. It was later joined by GDR, Albania, Mongolia, Cuba and Vietnam, as well as, in 1964, by SFRY under special conditions.

Competition East/West during the Cold War

During the communist period science was one and the same enterprise both in the Enwise countries and in Western countries, meaning that scientists from these countries participated *in one and the same competition.* Contemporary science however is a very *costly* enterprise. According to a Russian survey, "*the ratio between the material and technical foundation (necessary equipment) and information supply provided for Soviet science and Western countries' science (including USA) has been 1:100 during the communist period*". If this statement is reliable then it seems that the competition was lost even before it started.

Source: Sretenova, 2003.

Under the leadership of Mikhail Gorbachev in the 1980s, the Soviets ended their economic stranglehold on Eastern Europe and Comecon's goals were shifted in 1985 to a **comprehensive programme for scientific and technical cooperation**. Instead of the previous concentration on heavy industry, priority was given to five areas, in which Gorbachev thought Comecon was severely lagging behind the West: the **use of computers, complex automation, atomic energy, new materials and technologies, and biotechnology** (Gavin, 2001: 86).

The mobility of scientists and university staff was partially developed under Comecon inter-exchange programmes and networks and completely controlled by the USSR. The management of science during the communist period, i.e. the state S&T policy including funding mechanisms and the structure of R&D, was completely subordinated to these strategic aims.

Structure of R&D sector in the Enwise countries

In the majority of the Enwise countries, the R&D sector had two separate sub-structures. The basic and advanced research was carried out at the scientific Academies (the National Academies of Sciences, the Academy of Agriculture, the Academy of Medical Sciences, etc.), while the applied research and technological development shaped the so-called *branch R&D* in state research institutes under the auspices of different ministries and industrial enterprises. The two sub-structures constituted the *Government* R&D sector. The NAS of the Enwise countries operated as the main **National Research Centres** (like CNRS in France or Max-Planck-Institutes in Germany[6]) and at the same time as an association of eminent scientists (Western model of academy). The NAS employed the best scientists and enjoyed some privilege. For example, the Hungarian Academy of

6. During communist times, GDR always followed the Humboldt-model, by which universities were institutions of both teaching and research.

About JINR

On 12 August 1953, the detonation of the first Soviet hydrogen bomb (an H-bomb) was carried out against the backdrop of intense competition between the US and the USSR in the atomic energy sector. In 1954 in the small town of Obninsk near Moscow, work started in the first nuclear plant in the world. In 1954, the **European Organisation for Nuclear Research** (CERN), the world's largest particle physics centre was founded. In 1955, bilateral agreements between the USSR and several of the Enwise countries were signed in Moscow. For example, in 1955 a 'secret agreement' between the USSR and Bulgaria for co-operation in the field of nuclear physics and the usage of atomic energy for peaceful purposes was signed. In this agreement, the USSR envisaged helping Bulgaria to build an experimental nuclear reactor, as well as to train Bulgarian physicists in the area of nuclear physics. In 1956, a Convention was signed in Moscow between the USSR and representatives of the governments of some Enwise countries (Bulgaria, Czechoslovakia, Poland and Romania) plus other member states for the foundation of the **Joint Institute for Nuclear Research** (JINR), an international intergovernmental R&D organisation located in Dubna, not far from Moscow. JINR was created in order to unify the intellectual and material potential of the member states to study the fundamental properties of matter. JINR gradually changed from a purely scientific research institution into an international centre, where fundamental science, engineering and applied research were closely connected to training. According to the website of JINR: "*JINR occupies practically the same intellectual space as it did before the decay of the communist system in Europe*".

Source: Sretenova and Tripsa, 2003.

Sciences, being the principle scientific institution in the country, had the exclusive right to award scientific degrees. The NAS of Estonia, Latvia and Lithuania were subordinated to the Presidium of the Academy of Sciences of USSR, the HE institutions to the Ministry of Education of USSR.

Science under ideological repression

The ideological pressure on scientists and science varied across different institutional bodies (universities and scientific academies), as well as across disciplinary fields. The issue was highly dependent on the already defined strategic aims: winning the Cold War competition and building a rational socialist society. From this perspective the communist regime was more tolerant of NAS and of the governmental R&D as a whole, which was rarely the case with the universities. The reason for this *double standard* by institutional body was quite obvious. The academic staff of universities was supposed to teach, i.e. to educate the young generation of scientists and scholars. Therefore, *unreliable* academics were not to be admitted to teach the young people, especially in social sciences and humanities. Special attention was paid to the development of natural sciences (due to military interest) just in the same way as the competitor (the Western Block) did. The ideological pressure put on hard sciences was weaker in comparison to that imposed on the social sciences and humanities. The latter were supposed to back up the official party line and consequently no compromise was possible.

Ideological pressure and career building

In a market-oriented economy, careers in business rank first, followed by careers in politics, in arts and in sciences. During the communist past, business did not exist at all, politics had particular selection criteria and art was under control. It meant that HE and R&D were among the limited scope of available areas for careers. Because of the lack of many alternatives, HE and R&D sectors attracted the **nation's intellectual elite** of the Enwise countries.

Party membership was a precondition for a successful career building in both HE and R&D. A dual standard of assessing research quality and promotion was therefore set up. A basic principle for selection and promotion of the staff was the *class-party check up*. Members of the intelligentsia were *tolerated* by the ruling communist party because they had to pass through several mandatory *check-ups* in order to filter out those who were themselves, or their families, *foreign to the regime*. Even if such people did succeed in getting a position in university or research institutes, every step of their professional development was carefully monitored by the state party. Those deemed *unsuitable* remained at a low level in the science hierarchy until retirement. During this period, promotion to the academic ranks of Associate Professor and Full Professor required the approval of the ruling communist party.

During the communist period, the majority of teaching and research exchanges were planned within the Enwise countries and between these countries and USSR; as a group, these countries suffered collectively from relative isolation from the rest of the world. This issue of isolation is a sensitive topic, because it stems from the ruling communist regime. This issue has also to be framed in *terms of process,* i.e. in terms of time and in terms of location. It means that, at the beginning of this period, scientific isolation was more pronounced and gradually it was alleviated towards the end of the communist period. In terms of location, Slovenian scientists invariably, and Hungarian as well as Polish scientists partially (since at least the 1970s onwards) had opportunities to participate in conferences organised in Western countries. In all the Enwise countries, during the communist times, high level leading scientists, *reliable* scientists as well as the party-member *nomenclatura* met with no restrictions on their visits to Western countries.

The situation of R&D sectors of SFRY and Romania to a certain degree was not in line with the other Enwise countries. While the latter were transforming their NAS into a *Soviet type* academy, in the 1970s the Ceausescu political regime did just the opposite: the Romanian Academy of Sciences was detached from its 51 research institutes and was transformed into a Western type of academy, i.e. an association of the science elite (Glenday, 1993). This *elite* however was elected on a purely political basis.

Building upon those statements, an important question must thus be answered in this chapter: why was R&D of the Enwise countries, being so generously funded during the communist period, actually less effective when compared to that of the Western countries? Of course issues such as

Co-operation and competition in sectoral R&D: CERN and JINR, West and East poles of excellence in science

During the communist period, Comecon, the European Organisation for Nuclear Research (CERN) and the Joint Institute for Nuclear Research (JINR) were among the main pillars of directing (Comecon, JINR) or influencing (CERN) the scientific activities within R&D. CERN, one of the Europe's first joint ventures in R&D sector, and JINR were both founded to enable physicists from Western and Eastern countries to contribute to the issues of fundamental physics in ways that they could not have afforded acting separately.

During this period, different Enwise countries were involved in JINR's programmes of research and education (another good example of good practice and co-operation among the Enwise countries during the communist period was the joint R&D Programme "Inter-Cosmos"). Though such programmes had to abide by communist rules, their value in bringing together a pool of specialists cannot be underestimated. Different Enwise countries belonged or still belong to different JINR partnership systems of research and education in the field of nuclear energy. During the Cold War, CERN and JINR used to co-operate under certain programmes in complementary ways. This enabled the physicists from the Enwise countries working at JINR to have access to CERN as well. Currently the two organisations have several common member states, which was impossible during the Cold War. Nowadays, the following 20 countries are member states of CERN: Austria, Belgium, **Bulgaria, the Czech Republic**, Denmark, Finland, France, Germany, Greece, **Hungary**, Italy, the Netherlands, Norway, **Poland**, Portugal, **the Slovak Republic**, Spain, Sweden, Switzerland and the United Kingdom. A Cooperation Agreement between **Romania** and CERN was signed in 2002.

Source: Sretenova and Tripsa, 2003.

ideological pressure and isolation, selection mechanisms based on class-party check-ups, dual standard of assessment, etc. are relevant, but cannot answer this question comprehensively.

To do so, a closer look needs to be taken at the *science policy* of the communist period. Generally speaking, any *science policy* has five interrelated components: funding mechanisms, organisation and management, human resource potential, material and technical foundation (necessary equipment) and information supply. Looking for an answer to the above question, it can be argued that the mechanism of centralised planning of state R&D funding during the communist period contributed to the non-effectiveness of this sector, because the mechanism used to fund working places (headcount) rather than the research system itself.

How did the scientists from the Enwise countries, as well as the Russian scientists, enrolled in the *science centre,* cope with the stated research environments and infrastructure? A reliable indicator for measuring the effectiveness of communist R&D (of course not the only one) is the international rating of scientific publications, recorded by renowned international information sources, as well as by the registered citations in professional journals with a high level *impact factor*.

A reliable information source is the *Institute for Scientific Information*, Philadelphia (USA). This institute observes the scientific publications and their citations in three specialised data bases with a high rate of selectivity: *Science Citation Index* (SCI) for natural and technical sciences; *Social Science Citation Index* (SSCI) for social sciences and humanities; *Art & Humanities Citation Index* (A&HCI).

Seven steps towards international conferences…
(That a Romanian scientist had to pass in order to attend)

Step 1: To receive an invitation from the organisers; to justify the personal connection and relationships with organisers (where from, how they discovered you); to declare whether or not you have relatives in the destination country or generally abroad; to have recommendation of the head of department (usually a man).

Step 2: To receive the approval from the communist party organisation in the institution in which you are working.

Step 3: To receive the approval from the person in charge of secret information (so called *Securitatea*) at the level of the institution. He (*she* was never heard) had the permission to interrogate you, to collect information about you from different sources and finally to say *yes* or *no* without any additional explanations.

Step 4: To receive the approval from the Department of External Relations from the Ministry of Education (the head of department had been nominated by Elena Ceausescu and had the task to inform her about the possible journey).

Step 5: To receive the approval of the University Party Centre of Bucharest.

Step 6: All five steps were needed in order to prepare a dossier that had to be presented to the Internal Ministry – Passport Service in order to obtain a Romanian visa.

Step 7: To receive the Romanian visa; to obtain the foreign visa from the designated country's embassy in Romania.

Source: Tripsa, 2003.

Following Table 2.1 gives an insight into the relative share of publications and citations of the scientists from various countries, including several Enwise countries, towards the end of the communist period.

Table 2.1
Relative share of publications and citations of scientists from various countries (1989)

Country	Relative share of publications	Relative share of citation
USA	36.81 %	50.82 %
UK	8.96 %	9.61 %
USSR	7.27 %	1.63 %
Poland	0.88 %	0.38 %
Czechoslovakia	0.76 %	0.30 %
Bulgaria	0.24 %	0.06 %
Romania	0.15 %	0.05 %

Source: Scientometrics, V. 1-6, N° 16, 1989.

The same source also gives an indication of the R&D profiles and priorities of various Enwise countries towards the end of the communist period. It proves indirectly that in two disciplinary areas, Chemistry and Physics, the mentioned Enwise countries had a *similar R&D profile* as that of the *science centre* (USSR). Further studies would be necessary in order to explore this issue completely.

During the communist regime, scientists of the so-called Soviet Block were appropriately supported financially, but were sharply restricted, politically and ideologically. After the collapse of the communist regime, scientists were given political freedom, but were deprived of much of their previous financial support. The tragedy of the Enwise scientists, that can be extended to the Russian scientists too, is that unlike their Western colleagues, in the course of time, they either had funding or freedom, but never both at the same time[7].

The very system of R&D funding in the communist times (i.e. *supporting working places rather than the research system itself)* was not based on the principle of competition. On a personal level, this peculiarity of the funding system had several effects: all scientists were appointed on tenure positions and had a secured monthly income (salary); scientists enjoyed the *luxury* of devoting all of their time to research activities and not competing for project funding, which always and everywhere is an energy – and time – consuming enterprise. This particular situation entailed more effective work in the theoretical fields and less in the experimental fields of the R&D during that period. This *luxury* however had not always a positive impact on the effectiveness of the R&D sector as a whole: because there was no operating grant system and therefore no competition for project funding, hard work in the field of sciences was to a large extent *a matter of personal choice, commitment and interest in the research field* (as a rule, once appointed to a position in the R&D sector, a scientist could not be

7. This situation has prompted the American historian and philosopher of science, Loren Graham, to raise a question: "What is more important to science, freedom or money?"
In his recent study "*What have we learned about science and technology from the Russian experience?*", he answered this question in the following way: "The sobering conclusion that we must draw, in terms of scientific results, is that the support counts for more than the repression" (Graham, 1998: 130).

dismissed for reasons of poor performance). During the communist period, the R&D sector of the Enwise countries performed relatively successfully, not because of an existing organisation and management of science and a related funding system, *but in spite of it.*

Transitional period (1990 - 1998/9)

The collapse of the communist regime in 1989 brought a high level of turbulence in the Enwise societies with the follow-up re-arrangement of their value systems, the setting-up of new agendas, the fading of old illusions and the rise of new ones. The common aim of the Enwise countries was to *return to Europe*, where *they had already been for more than a thousand years* and to a market-oriented economy and society, *which they had already developed* during the first half of the 20th century.

In order to understand the ongoing processes, one must keep in mind that all the Enwise countries were keen to return to their national pre-communist cultural traditions and to reshape all spheres of public activity in accordance with them. During the first years following the changes, the collective public mind was obsessed by the idea of going *back to our roots*. This special kind of *romantic inclination* partly explains why the Enwise countries followed different paths, when pursuing one and same common goal: the reform of their HE and R&D sectors in order to make them more effective and competitive in a democratic and market-oriented society. According to the adopted methodology[8], and outside of the romantic inclination mentioned above, the following question has to be answered: what was the country playing the role of *science centre* for the Enwise countries during this transitional period? This is a key issue, because it concerns the transfer of HE and R&D models from the *science centre* and their follow-up adaptation and implementation in national contexts. A tentative hypothesis is that the USA played this role for the majority of the Enwise countries, in particular in relation to the adoption of HE models during this period. However, to confirm or reject this hypothesis, i.e. to show whether American or European trends dominated the reshaping of the Enwise countries HE sector, one would need a specific comparative study of the HE models of the Enwise countries, which is outside the scope of this report.

During the transitional period, the complex transformation of HE and R&D sectors in the Enwise countries passed through two different phases: the first one, from 1990 to 1995, which could be identified as a ***bottom-up*** driven phase and the second one, from 1995 to 1998/9, as a ***top-down*** driven phase. It is proposed first to analyse the transformation of R&D sectors and then that of the HE sectors (however, where relevant, the HE sector is referred to within R&D analysis as well).

8. J. Ben-David's concept about science centre and science periphery.

The **transformation of the R&D sector** meant a deep and sometimes dramatic change of the full-scale of its components, i.e. legislation, S&T policy, management bodies, organisational structure, institution framing, etc. The Enwise countries have again been clustered, this time in two groups, in order to avoid drawing any generalised picture that would be misleading:

- Bulgaria, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic and Slovenia, identified afterwards for short as CEECs;
- Estonia, Latvia and Lithuania, i.e. the Baltic countries.

The *scientific community effort - Bottom-up* driven phase of transformation of R&D sectors

In the CEECs

The first step towards the restructuring of HE and R&D sectors was the improvement of legislation. The CEECs adopted new acts[9] on HE and R&D, which aimed to restore the *academic autonomy* of both types of institutions (NAS and universities) and to restore *academic freedom*. This first step was also in line with the process of democratisation of the R&D sector and resulted in an overall *decentralisation* of the functioning of the institutional structures. The latter became *self-governing* research units. From then on, the initiative at the level of research units or even at the level of individual researchers had been launched. This step was also a kind of renewal of the national pre-communist cultural tradition, where the NAS and the universities were autonomous institutions. At that time, the R&D sector faced a sharp decrease in and a shortage of budget subsidiaries.

9. In 1990 (HE) and 1991 (BAS) for Bulgaria, in 1990-92 for the Czech Republic, in 1990 for Poland, in 1990-92 for Romania…

Reduction of R&D personnel in the Czech Republic

To demonstrate the **scope of the reduction**, figures concerning the example of the academy of sciences as the main research institution in the Czech Republic are very instructive. The total number of **research centres** has fallen from 85 to 59 and the overall number of **staff** dropped from 13 896 in 1989 to 6 972 in October 1993.

Source: Havelková, 2003.

Reduction of R&D personnel in Bulgaria

In 1989 the Bulgarian Academy of Sciences consisted of 122 research units, nowadays it comprises **68 research units** (Institutes, Centres and Labs). The total number of the research personnel in the Government R&D sector has fallen from 12 842 in 1993 to 6 387 in 2001 (i.e. a reduction of 50.2%).

Source: Sretenova, 2003.

Assessment of Polish R&D activities

In Poland, this second step was accompanied with the introduction of a peer review system: "The peer review system introduced in 1991 was based on the principle of the assessment of research and development activities by representatives of disciplines and fields of science elected in two stages by the academic community (those with a PhD and above). The review took place at a number of levels (reviewers, sections, teams).

The final review committee consisted of 12 representatives of the community and 7 ministers nominated by the Prime Minister. Thus, the assessment included a political element, as the relationship between research and current policies of the government and of individual ministers was taken into account".

Source: Oleksy, 2003.

The situation, as it was, suggested a kind of *adaptation strategy* undertaken in all post-communist NAS (Government R&D) and led to the second step of the restructuring of *R&D*.

- *The second step* towards the restructuring of the R&D sector was related to the drastic reduction of R&D personnel in most CEECs. The NAS of the Enwise countries, on the basis of their new legal status of independent self-governing research institutions, reformed their structures in order to *optimise* the number of their research units and the number of their R&D personnel.

  In the CEECs, the process of the reduction of R&D personnel went in parallel with a process of assessment of research and development activities at different levels – starting with the individual researchers and ending with the research organisations as a whole.
- *The third step* towards the restructuring of the R&D sector was related to the introduction of new funding mechanisms for R&D on the basis of a grant system. NAS as the main representatives of Government R&D in the majority of the *CEECs*, with the exception of Poland and Slovenia, still received their budgets **directly** from the state (as it was during the previous period) and then distributed the money to the individual institutes. The related boxes show that the newly shaped grant agencies and foundations for financing the research activities on the basis of competition are more or less additional sources of funding for R&D in CEECs. Some innovative private non-profit R&D[10] emerged outside the Government R&D in Hungary and Poland respectively.

10. According to the Frascati Manual, the R&D activities are heading under the four sectors of economy: Higher Education sector (HES), Government sector (GOV), Business and Enterprise sector (BES) and Private non-profit sector (PNP).

New funding systems in the Slovak Republic

In the Slovak Republic, 0.59% of GDP in 2002 was allocated to the R&D sector, from which 0.30% of GDP was financed from the state budget.
The special state bodies - Agency for Science and Technology and VEGA (Scientific Grant Agency) deliver research grants on the basis of competitions. The annual support offered by these two granting bodies should be considered as additional income towards the budget of the Slovak Academy of Science, which is financed mainly from the state budget.

Source: Velichová, 2003.

New funding systems in Hungary

In Hungary governmental R&D financing constitutes about 65-70% of the total funding of the Academy and the universities. The grants awarded by different governmental granting bodies such as OTKA (Scientific Research Fund), MÜFA (Technological Development Fund) and NKFP (National Research and Development Programme) make up the majority of this funding.

Source: Groó and Papp, 2003.

New funding systems in Poland

In Poland, the Ministry of Scientific Research and Information Technology distributes funds to the Polish Academy of Sciences and other R&D institutions that it supervises. R&D institutions may also have their own sources of funds, for example they conduct research for which they take grants commissioned by other parties.

Source: Oleksy, 2003.

New funding systems in Bulgaria

In Bulgaria the subsidy from the state budget comprises about 80% of the income of the Bulgarian Academy of Sciences and the grants from the National Research Fund (a state body, which deliver grants on the basis of competition) is about 3% annually.

Source: Sretenova, 2003.

□ *The fourth step* towards the restructuring of the R&D sector was related to the gradual emergence of the HE R&D sector, i.e. *research activities developed in HE institutions,* which either was lacking or had been neglected during the previous period. The introduction of new mechanisms for financing research activities had a positive impact on the initiation of university research, because research became one of the additional sources of funding. However, the newly established research centres affiliated with the university departments emerged as autonomous structures in terms of state funding. The former divide between teaching and research activities became somehow particularly reproduced within the HES of R&D itself. Evidently, despite the efforts, the *Soviet* R&D *model applied* for nearly half a century in most CEECs could not be easily overcome. More time is needed for vital integration of the research activities within the universities than initially was expected.

During this phase, most CEECs adopted new laws for higher education and in relation revised their systems of scientific degrees[11]. In Hungary, the universities got back their right to award the academic degree of PhD (In Bulgaria, Czech Republic, Poland, Romania, Slovak Republic and Slovenia, the universities had always had the right to award this degree, even during the communist period).

The CEECs passed through almost the same first phase of transformation of their R&D. All of them preserved their NAS (in a reduced form) in accordance with their national cultural traditions. The separation between research and teaching activities still exists in some of these countries. NAS still receive *direct funding* from the state budget (with the exception of Poland and Slovenia). In addition, these countries have preserved the former two-level system of scientific degrees, with the exception of Romania and Slovenia, where this system was never introduced.

11. An insight in the hierarchical structure of scientific degrees system and academic titles/ranks within HE and R&D in the Enwise countries can be found at Annex 3 of this report.

Slovenian good practice

Since 1985, Slovenia introduced a special funding scheme for young scientists for Masters and PhD studies. The Slovenian government is also trying to stimulate applied research by offering to research institutes and university support for projects that already obtained commitment for partial funding from industry.

Source: Mladenič, 2003.

Private non-Profit R&D in Hungary

The Bay Zoltán Foundation is the largest research foundation in the country. It was founded in 1993 by the National Committee for Technological Development and it has three research institutes: the Institute of Biotechnology, the Institute of Material Science and Technology and the Institute of Logistics and Production Engineering. It is financed by grants, R&D contracts and interests (non-governmental funding).

Source: Groó and Papp, 2003.

Private non-Profit R&D in Poland

In Poland, following the introduction of a market economy, private R&D institutions came into being, and independent branch institutes were established. New, autonomous research centres, such as the A. Smith Institute in Warsaw or the Case Foundation, were also set up. The institutions mentioned here are set up as foundations, thus they are financed by private funds. They describe themselves as independent, private, non-commercial, non-profit institutions.

Source: Oleksy, 2003.

A reflection upon this first phase of transformations of R&D in the CEECs reveals some deficiencies. The re-building of the R&D sector in these countries started without an elaborated national strategy or at least a vision for the long-term development of this sector and as a consequence this brought some loss. In particular, the so-called *branch R&D* was the most negatively affected by the reforms and in fact was **completely dissolved** in the majority of CEECs, with the exception of Hungary.

- **In the Baltic countries**

  As a group Estonia, Latvia and Lithuania inherited quite a developed R&D sector from the former USSR. However, this sector was tailored to serve the needs of the large Soviet Union. As a consequence, their former advantages turned into disadvantages, because in the transitional period to market economy, this R&D sector could not sustain its capacity and had to be reduced to match the opportunities and needs of a small independent country: it had not, however, been designed for this purpose. From this point of view one can understand why the transformation of the R&D sector of the three Baltic States was **more radical and more dramatic** compared to that of the CEECs. Generally speaking, the formal pattern of transformation of R&D sector, in the Baltic countries, was the same. However, the content and the context of this formal pattern were different compared to that of the CEECs. A comparison between the Baltic countries and the CEECs is presented hereafter, which focuses attention on the differences of their transformation processes.

  - *The first step:* The three Baltic countries created a new legislative basis targeted at their R&D[12] sectors. The new legislation on research activity adopted by the Baltic countries during the first phase of transformation of the R&D sector re-established not only the principle of autonomy but also founded the basis for integration of the research activity into universities. At that time, the CEECs focused their attention on the creation of a legislative base for transformation of the HE sector.
  - *The second step:* In 1994, Estonia transformed its *Soviet type* Academy of Sciences into a Western type academy, i.e. an *association of eminent scientists.* The same happened to the Latvian and to the Lithuanian Academies of Sciences. The former research institutes belonging to these academies (17 research institutes belonging to the Estonian AS, 18 belonging to the Latvian AS and 19 to the Lithuanian AS) faced a different fate: part of them were closed, part of them became independent state research institutes under the auspices of the respective Ministry of Education and/or Science and part of them were integrated into the respective universities.

Changing the law in Slovenia

Slovenia was maybe the only country in CEECs, which during this phase focused attention on promoting R&D legislation as well. A law on research activity was passed in Slovenia in 1991 as well as several acts on funding national research programmes in 1994.

Source: Mladenič, 2003.

12. Estonia: "Organisation of Research Act" (1994) and "Universities Act" (1995), Latvia: "Law on Research Activity" (1992), Lithuania: "Law on Research and Higher Education" (1991).

Therefore, the main difference between the transformation of R&D of CEECs and that of the three Baltic States is that, while the latter preserved their NAS, which still function as public governmental research organisations, the three Baltic countries transformed their NAS into public non-governmental organisations. As a consequence, the three Baltic countries, unlike the other Enwise countries, completely transformed their previous governmental R&D sector.

- *The third step:* The three Baltic countries transformed the structure of research financing in a radical way, i.e. completely. For example in Estonia, the *Estonian Science Foundation* (ESF) and the *Innovation Foundation* (now part of the *Enterprise Estonia Agency*, EAS) were established in order to cover the financing of all stages of R&D. An entirely new grant system was introduced as an instrument for promoting S&T policy in a competitive way.

■ The *policy makers' effort – Top-down* driven phase of transformations of HE and R&D sectors

This phase aimed to shift the focus towards defining national priorities, needs and opportunities of the Enwise countries at the level of the respective ministries supported by the newly shaped advisory bodies. During this second phase, Hungary seemed to be the most successful in changing the structure of financing research and displayed a growing share of its R&D budget in the private sector. This was not the case in the other CEECs. During the same phase, the three Baltic countries[13] revised their respective R&D legislation as well as the mechanisms of financing their research institutes. From 1995 to 1998, the three Baltic States[14] integrated the research institutes, formerly belonging to their NAS, into the universities. However this integration appeared rather as a formal process than as a real integration, because the state research institutes are still legally independent units within the university framework.

■ Decreasing public image of science and scientists in the transitional society

Most members of the Enwise Expert Group claim that low investment in science, poor research environment and infrastructure, and low salaries for scientists contribute to the withdrawal of scientists from the profession. These reasons, however, tell part, not all, of the story. Other reasons for the fading prestige of science and scientists might be that, firstly, during the transitional period, the defined strategic aim disappeared. It means that science and scientists from the Enwise countries were no longer in charge of the great responsibility which previously was to win the Cold War and to build the rational socialist society. Secondly, during this period, prospects for new attractive careers outside the R&D sector emerged. The period offered new horizons and a completely new intellectual landscape for personal creative activities and initiatives. In this context, the new media lost any interest in building the public image of science and scientists in society, because they had also their new priorities and agendas.

13. Some details of R&D transformations in the three Baltic countries are presented in Annex 4 of this report.
14. In Lithuania, two types of state research institutes can still be found: university research institutes, included in the university framework and state research institutes, independent of the university.

From legislative reform to implementation: HE reform in the Enwise countries

In the transitional period, the **transformation of the educational system** in the Enwise countries reflected fundamental social and economic processes. Education as a main source of qualified labour power had to respond to the new challenges of life. The basic factors that imposed the reform of the educational systems during this period were connected with the transition to market economy and significant changes in the institutional, economic and social infrastructure.

Many of these changes were generally marked by the same rhythms as the social and economic reform: hesitation and slowness and attempts to overcome existing blockages, which were threatening to turn into a crisis, through simultaneous reforms in each and every education sector. Different surveys dealing with the reform of education, after the fall of communism in the Enwise countries, identify **2 main phases**, with specific goals and results:

- Phase of ***transition*** (1990-1995) that could be called phase of ***identifying the needs and building up the context of legislation***, which included the following specific stages:
  - **deconstruction** (1990) characterised by the elimination of the ideological indoctrination from education and, in general, by the elimination of the restrictions inflicted by the communist educational policy; one of the most important steps of that time was the generation of new legislation[15] for HES, allowing for university autonomy;
  - **stabilisation** (1991/92), considered as a stage of consolidation, after the tempestuous changes that took place after the fall of communism; the issues of democratisation and decentralisation are relevant for this stage.
- Phase of ***comprehensive or accelerated reform*** (1995-1998/9), accompanying the **enlargement process** and consisting of changes catalogued in six chapters: the curriculum reform (educational planning, programmes, textbooks) and European adjustment of the national curriculum; the transition from learning by rote to problem solving learning and **re-launching of university scientific research**; a new connection between schools, high schools, universities and their economic, administrative and cultural environment; school and academic management reform through decentralisation; increase of the educational institutions autonomy; infrastructure improvement and connection to world communication lines; and advanced forms of international co-operation.

15. An overall review of the laws on HE adopted in the Enwise countries can be found at Annex 5 of this report.

New legislation on HE in the Enwise countries

Important issues came out through the new legislative processes adopted during the transitional period, such as: the elimination of the political factors in the process of education; university autonomy; the development of private education as an alternative for public education; the accreditation of the HE institutions; the necessity of quality standards for HE sector; the implementation of new curricula in HE institutions increasing the interest of integration of the research activities into these institutions; re-introduction of research achievements as standard career criteria in HE; the introduction of the grant system with the possibility to finance research university projects; the *numerus clausus* has been maintained and interested students must pass admission tests.

Source: from the various members of the Enwise Expert Group.

Each of these two phases triggered differentiated processes with the following consequences:

- The **number of universities** - state and private educational institutions - has increased; the development of this double system of higher education, namely state and privately owned institutions, should be underlined in all the Enwise countries. Table 2.2 below shows the current number of HE public and private institutions in the Enwise countries. Their increase can be partly explained by the new private sector, which did not exist before 1990, with only one exception: the Catholic University of Lublin in Poland.
  The diversification in the ownership of the education system created more competition between providers, who faced new challenges for quality and innovation in the system. These private initiatives also triggered diversification in the educational offer, providing the students with a wider choice of programmes.

Table 2.2
Public and private universities in the Enwise countries (2002)

Country	State institutions	Private institutions
Bulgaria*	37	5
Czech Republic	26	30
Estonia	6	4
Hungary**	55	34
Latvia***	20	13
Lithuania	19	7
Poland	105	277
Romania	56	18
Slovak Republic	21	2
Slovenia****	3	8

Source: *from various members of the Enwise Expert Group.*
Notes: * *In Bulgaria, in addition to these 42 universities, there are 48 Colleges (of which 6 are private)*
** *Hungarian data for 2001*
*** *In Latvia, among the 33 HE institutions, 5 of them are state universities*
15 are state higher education establishments and 13 private higher education institutions
**** *In Slovenia, among the 8 private institutions, 5 are faculties and 3 HE institutions*

- The number of **university students** – both male and female – has increased. The structure of the relative share of students in the **different fields of studies** shows a certain correspondence between the demands of the changing labour market and related economic reforms. Nowadays, students' preferences concern mostly disciplines such as: business and administration, engineering, law, economics and social sciences,

Increasing number of university students in the Enwise countries

In some of the working documents 2003 provided by the members of the Enwise Expert Group, the following figures are reported:
- Bulgaria: the number of students increased from 116 407 in 1987 to 247 006 in 2000/2001;
- Hungary: in 1989/90 the number of students' enrolments reached 100 868; by 1997-1998 this number had climbed to 233 657 and reached 313 238 in 2001/2002;
- Lithuania: the number of students decreased from 67 312 in 1990/91 to 51 482 in 1994/1995, and increased to 95 593 in 2000/2001;
- Romania: in the 1990-1997 period, the number of students rose to 168 000 students in HE public and private institutions, representing the double of the figure for1990;
- the Slovak Republic: in 1989/1990 the number of students reached 63 466 and climbed to 131 088 in 2001/2002, while the number of female students has been over half of the total study body since the academic year 1997/1998.

while there is a declining interest in mathematics, natural sciences and physics. There is a tendency to choose soft sciences, the result of which is that there are many graduates in this area and not enough in hard sciences. In addition, there is no effort made to encourage girls to take an interest in technological universities and computer sciences.

- **Computer science** has become more popular among students, even though the Slovenian case indicates a different trend: while in former Yugoslavia 40% of students in this discipline were women, during the transition it dropped to less than 10% of women. But this trend cannot only be explained as a *reaction to the science system established during communist times*, since these kinds of students' preferences can be understood as common to both post-communist and Western countries. Hard sciences lost their attractiveness for young generations as they did in the West. It can be concluded from the various data collected by the members of the Enwise Expert Group that, in **engineering** and **technology**, the success of women in receiving a Master's degree is noticeably higher than for men.

  The situation is quite the reverse in the **humanities fields**, where men are more successful than women. Presumably the **demand of the labour market** plays an important role here. As women researchers in humanities often cannot find jobs straight after graduation with a Bachelor's degree (BA), they are likely to continue their studies at Master's level (MA). The situation concerning the professions of engineering and technology is the following: the demand of the labour market for male students is high, hence most of them quit Master's programmes without defending their theses, since they have already secured employment during their studies. Women students are apparently not so favoured on the labour market and their success rate in defending their theses is therefore much higher. However, the shift from an elitist to a mass university system is not satisfactory due to budgetary constraints, which create problems in recruiting teaching staff, satisfying students' demands and implementing the structural reform of the university.

Distribution of students by field of study

IIn the working documents 2003 provided by some members of the Enwise Expert Group, the following figures are reported:
- in Bulgaria: during the period 1990-2002 the following specialities were and still are the most attractive for Bulgarian students: Business and administration, Law, Economics and Social Sciences. The structure of students by field of education in 2001/2002 shows the following picture: 21.9% involvement in Business and Administration, 17.5% in Engineering and Engineering trades, 12.9% in Social and behavioural Sciences, 9.4% in Educational Sciences, 7.3% in Humanities, 5.3% in Law, 1.6% in Physical Sciences, 0.5% in Mathematics, 0.6% in Life Sciences, etc.;
- in Romania: the same trends were observed as in Bulgaria;
- in Estonia: in relation to certain fields of study, several interesting trends can be noticed regarding the success of master's studies as well as the gender-balance of students. In Humanities, the total number of women accepted is almost three times the number of men, but in defending their theses, men are more successful. Of those accepted onto the Master's programme, every fourth woman and every third man defend their theses. Engineering and technology are strongly masculine fields, where men are four times more present than women, but the success in defending among men and women is equal (every fourth).

- The proportion of **women in the university staff** had increased by the end of the transitional period, achieving a significant percentage, as revealed in Table 2.3 below.

Table 2.3
Female participation in university staff as a % age of the total university staff in 9 Enwise countries (1999)

Country	Female teaching staff (%)
Bulgaria	40.2 %
Czech Republic	31.7 %
Estonia	43.7 %
Hungary	53.6 %
Latvia	78.6 %
Lithuania*	31.5 %
Poland	45.2 %
Romania	35.1 %
Slovak Republic	39.0 %

Sources: *Enwise Expert Group working documents.*
Note: * = only having a scientific degree or an academic title

Although women constitute a significant proportion of graduates of different schools of HE as well as occupying a significant proportion among the university staff, the ones with a successful university career are much fewer. Additionally, career development is also strongly dependent on the field of study. At the end of the transitional period, a **gender vertical segregation in HE** has to be underlined as can be observed in following Table 2.4.

Table 2.4
Share of women from the Enwise countries in HE positions at the end of the transition period (1999)

Country	Full professors	Associate professors	Assistant professors	Lecturers
Bulgaria	16.4 %	30.7 %	44.4 %	56.5 %
Czech Republic	7.2 %	20.0 %	41.6 %	56.4 %
Estonia	16.5 %	31.6 %	50.9 %	68.0 %
Hungary	11.6 %	33.0 %	40.0 %	Unknown
Latvia	18.0 %	40.0 %	43.0 %	68.0 %
Lithuania	11.6 %	33.1 %	*	Unknown
Poland	15.5 %	21.7 %	20.9 %	38.8 %
Romania**	10.2 %	32.0 %	45.0 %	Unknown
Slovak Republic	8.0 %	25.0 %	48.0 %	Unknown
Slovenia	10.0 %	15.0 %	20.0 %	Unknown

Source: *Enwise Expert Group - Working documents 2003 and WiS database.*
Notes: * in Lithuania, the title Docent corresponds to both Western Associate & Assistant professors
** taking into account only 10 of the main state universities in Romania

The university staff duties in the field of teaching increased as a consequence of the increasing numbers of students, which does not facilitate extending the research capacities in universities. Taking into account the high percentage of women at the positions of lecturer and/or assistant professor, the situation suggests that the majority of university

women are used as ***workers of education*** with little space left for their research. Furthermore, combined with their **low remuneration**, this situation is both profitable for the university system and meets the social demand of universities, namely, to provide increasing services under conditions of **stagnating funding**.

Funding of education and investment policy are other essential issues and constitute a prerequisite for access to education. University research in the period of transition remains a special problem. The system of duties is still unclear and sabbatical years are recognised, but too little used.

The number of women in leadership positions in HE institutions is still very small as can be seen in the data concerning the position of university rector in Table 2.5 below.

Table 2.5
Gender distribution of HE rector positions in the Enwise countries

Country	Women	Men
Bulgaria*	1	41
Estonia**	1	56
Hungary***	8	57
Latvia****	1	4
Poland*	24	255
Romania*	1	45
Slovak Republic * &	0	23
*****	15	63
Slovenia*	1	2

Source: *Enwise Expert Group - Working documents 2003.*
Notes: * University Rector
** Estonian Academy of Sciences
*** Number of rectors at universities and colleges in Hungary
**** In Latvian universities, there are 1 woman and 4 men in rector positions (in table); in other state higher education institutions, there are 2 women and 13 men in rector positions and in the private sector, 5 women and 8 men hold rector positions
***** University vice-rectors

HE Reform and Enlargement process

During the period following 1998/9, the Enwise countries adopted a *policy of integration to the European Union*. The evolution of intrinsically *linked processes,* during the enlargement period in the Enwise countries allows for a three dimensional analysis of the roles played by the **European Commission**, the **state-level governments** and the **HE institutions** to achieve the common goal of EU integration:

- **European Commission:** The **Sorbonne declaration** of 25 May 1998, stressed the universities' central role in developing European cultural dimensions. It emphasised the creation of the European area of higher education as a key way to promote citizens' mobility and employability and the continent's overall development. On the other hand, the Commission opened the doors of its research programmes to the universities of the Enwise countries, starting with FP5 and continuing much more with FP6.

- **State-level governments:** 29 European countries, including the Enwise ones, aiming to reform the structures of their higher education systems in a convergent way, signed the so-called **Bologna Declaration**, a joint declaration of the European Ministers of Education (19 June 1999). It is a key document, which marks a turning point in the development of European higher education. The fundamental principles of autonomy and diversity in HES already obtained by the national legislations are completely respected. The Declaration recognises the value of coordinated reforms, compatible systems and common action.
- **HE institutions:** national strategies were elaborated in the Enwise countries and real comprehensive reforms in HE began.

Challenges facing HE and R&D sector during the transitional period

During the transitional period, HE and R&D sectors of the Enwise countries met with four main challenges: shortage of funding, low salaries, brain drain and ageing issues. Each of these challenges has a specific gender dimension: the relationship between gender, funding and salaries will be further discussed in Chapter 3.

Shortage of funding

By looking at R&D expenditure as a percentage of Gross Domestic Product (GDP) during the transitional period, it is possible to examine the trends in R&D expenditure in each national economic context. In the eight Enwise countries for which data are available, there was decline in Gross Domestic expenditure on R&D (GERD) as a percentage of GDP between 1992 and 1996, although the situation starts to pick up again after 1996 as can be seen in following Table 2.6:

Table 2.6
R&D expenditure as a percentage of GDP, selected years between 1992 and 2001

Country	1992	1995	1996	1997	2000	2001	*%age change between 1992-1996*	*%age change between 1997-2001*	*Difference in R&D expenditure as a %age of GDP between 1992-1996*	*Difference in R&D expenditure as a %age of GDP between 1997-2001*
Bulgaria (1)	1.64 %	0.62 %	0.52 %	0.51 %	0.52 %	0.47 %	*-62.0 %*	*-8.0 %*	*-1.12 %*	*-0.04 %*
Czech Republic	1.72 %	1.01 %	1.04 %	1.16 %	1.33 %	1.30 %	*-41.0 %*	*12.0 %*	*-0.68 %*	*0.14 %*
Estonia	:	:	:	:	0.66 %	0.78 %	:	:	:	:
Hungary	1.05 %	0.73 %	0.65 %	0.72 %	0.8 %	0.95 %	*-30.0 %*	*32.0 %*	*-0.40 %*	*0.23 %*
Latvia	0.59 %	0.53 %	0.47 %	0.42 %	0.48 %	0.44 %	*-10.0 %*	*5.0 %*	*-0.12 %*	*0.02 %*
Lithuania	:	0.46 %	0.52 %	0.56 %	0.6 %	0.69 %	:	23.0 %	:	0.13 %
Poland	0.83 %	0.69 %	0.71 %	0.71 %	0.67 %	0.68 %	*-17.0 %*	*-4.0 %*	*-0.12 %*	*-0.03 %*
Romania	0.85 %	0.80 %	0.71 %	0.58 %	0.37 %	0.39 %	*-6.0 %*	*-33.0 %*	*-0.14 %*	*-0.19 %*
Slovak Republic	1.80 %	0.93 %	0.92 %	1.09 %	0.65 %	0.64 %	*-48.0 %*	*-41.0 %*	*-0.88 %*	*-0.45 %*
Slovenia	1.91 %	1.61 %	1.36 %	1.35 %	1.46 %	1.57 %	*-16.0 %*	*16.0 %*	*-0.55 %*	*0.22 %*

Source: Eurostat, S&T statistics. Data for Slovak Republic from Velichová, 2003.
Notes: (1) Break in time series 1996 and 1999 - : = non available

Matters started to improve for the Czech Republic, Hungary, Lithuania and Slovenia during the period 1997-2001. In Bulgaria, Latvia, Poland, Romania and the Slovak Republic there is no evidence of an improvement in R&D as a percentage of GDP in the late 1990s. Bulgaria experienced the sharpest decline in R&D as a percentage of GDP – from 1.64% in 1992 to 0.47% in 2001 – nearly 1.2% of GDP and Hungary had the most stability with a small decline of 0.1% of GDP during the same period. Further consequences of these trends are analysed in Chapter 3.

- **Low salaries in HE and R&D sectors**
  The low level of salaries gives rise to a new phenomenon of **double employment**, or even of triple employment, of the academic and research personnel of the governmental HE and R&D sectors. It is a public secret that even the lowest salary within the private sector and state administration exceeds the highest one within the HE and R&D sectors. The phenomenon of double employment became possible because of the increasing number of universities and equivalent higher education institutions and the corresponding increase in the number of students during the transitional period.

- **Brain drain in the Enwise Countries – Mobility or Loss?**
  The exodus of researchers during the last decade was a real challenge for R&D sectors of both EU Member States and the Enwise countries. Researchers' brain drain is one of the key concerns because a substantial public capital had been invested in their training with supposed benefits for research to be brought back to society. EU talents and skills are drained towards the USA and to a lesser extent to Canada and Australia, while the human resources from the Enwise countries are drained towards the EU Member States, the USA, Canada, Australia and South Africa.
  The brain drain issue is a phenomenon of complex and complicated nature. It is difficult, if not impossible, to measure brain drain in statistical terms, because one cannot know in advance the individual plans and life scenario of each mobile researcher – to return home, to stay permanently in the host country or to move on to another country. Therefore a potential risk that the temporary international mobility will turn into brain drain always exists in each individual case. The current situation suggests shifting the focus from the aim of **measuring** brain drain to that of **understanding** the issue of brain drain, i.e. to identify factors that motivate researchers to emigrate. The main factors, which underlie personal choices for emigration of researchers from EU and Enwise countries, are similar, although some important differences exist too, because migrant scientists and researchers form a special group with shared values. Within this group, social factors leading to brain drain matter as much as the economic factors.

□ **Why it is so easy to attract scientists, in particular from the Enwise countries, to work abroad?**

As it is well-known, opportunities are the driving force behind human behaviour. It is very important to understand why mobility opportunities too often mean for EU researchers a one-way ticket to the USA and for researchers from the Enwise countries a one-way ticket either to the EU and the USA, directly or, indirectly, following a temporary stay in the EU. Generally speaking migration of working populations as a whole strongly depends on political, social, economical and geographical factors. Researchers and scientists however shape a special group for which different motives trigger off the migration process. Traditionally, scientists and researchers have a special personality or a specific profile and their world view differs from that of other groups. As a special group, they value firstly the quality of the research system and its environment; secondly the notion of freedom, in particular academic freedom; and thirdly, unlike other migrants, this group is able to overcome the cultural and linguistic barriers of their host society. In their value system, research conditions, working environments and practices are of high priority, i.e. existing facilities, developed research infrastructures, effective work organisation, possibility of publishing scientific results, etc.

However discourses on mobility seem to have different contexts in the EU and in the Enwise countries. In EU Member States, they seem to be related to topics such as flexible structure of career paths and salaries, promotion prospects within the career, opportunity for obtaining permanent position at the home higher education and research institution, the shaping and functioning of the post-doc system in the respective country, the diversity of the *return scheme grants*, satisfaction, stability, etc. In the Enwise countries, discourses on mobility appear as a personal choice between two options - *frozen brain* at home or *brain drain* to foreign countries. It is not a major surprise then, that most of the brilliant and skilful scientists (be they junior or senior ones) prefer the mobility option and in fact a *nomadic style of life* in order to be able to practice their profession in an effective and productive way. Recognition in the profession is also important for them as it is for every other scientist in the world. One cannot make a name for his/herself, working in a small country in the research periphery of Europe, with limited access to the international professional community and correspondingly to limited opportunities for publishing in the most prestigious international journals in their field.

The conclusion which draws from the picture outlined above is that the economic factor by itself (the current unfavourable economic situation of the Enwise countries and researcher's poor salaries) can tell only half of the story about the exodus of researchers and about their motivation for leaving their countries. No doubt, the economic factor is important - at the same time quite a well studied part of the question -, but it cannot be

considered the sole explanation of the brain drain issue in the Enwise countries. The quality of the research system ranks first, as a priority factor, followed by the quality of life in a broader sense. As already said one of the reasons for scientists to leave their home country is that they are fed up with local frustration and the complexities of the environment.

- **Counter productive flexibility of women researchers from the Enwise countries**

All Enwise countries (with the exception of Slovenia) currently face a brain drain problem. It might be claimed that the situation is suggestive for reflection in terms of **brain loss** (both internal and external) instead of **brain circulation**.

The analysis supports the following tentative hypothesis: in the majority of the Enwise countries the *external & internal brain* ***waste*** dominates over the *external & internal brain* ***drain***. The current situation rather raises more concerns about each country's *loss of intellectual human capital* than for *actual brain drain* process.

Several members (Estonian, Lithuanian, Slovenian…) of the Enwise Expert Group explicitly stated that once a woman is in research, she tends to stay, because she has already invested a lot, and there are not that many alternatives. It means that women researchers who are leaving science should be considered as *brain loss*. As underlined in Chapter 1, women in the Enwise countries facing difficult economic situations are inclined to accept a job below their qualification and in general to work for lesser wages, which is rarely the case with their male counterparts. This flexibility of attitude towards the labour market in fact makes them prospective emigrants.

The four Ps … that highlight the brain drain issue

A sarcastic view of the problem has been developed (not by me) for graduates and those in higher positions, represented by three Ps: **Prestige**, **Payment** and **Pleasure**. Out of three Ps, you should always find two on your side. The three possible combinations show a rough spectrum of the categories in which the graduates can be placed. I will add a fourth P: **Policy/Politics**, which is on a different level and regulates the relations between the three Ps. It is always important for a graduate to define his/her place in relation to the political environment (…). *The Ps are highly metaphoric, of course. Prestige does not only mean scholarly recognition, but also an attractor for investment or further accumulation of excellence; Payment is a cipher for all kinds of material rewards, social benefits, pension plans and the material environment of a working situation; Pleasure is the most difficult to explain, because it includes individual private interests, care for others, moral and aesthetic categories and everything that adds to a 'good life'. None of these categories is 'pure'. However, the three Ps are indicators for the main aspects which refer to the interdependence between the individual and the system. The fourth P is self-explanatory. But it has two sides: a subjective one, where the individual 'brings about' a political impact by deciding whether to stay or to leave, and the objective one, by which one person may be forced to stay or to leave. They are decisive for relevant choices in a professional career.*

Source: Professor Dr. Michael Daxner, University of Oldenburg, Germany, speaker and participant in the Enwise workshop "Starting a debate with women scientists in the Balkan region", Brussels, November 2003.

- **Ageing of academic and research staff**

As shown in Chapter 1, during the transitional period in the Enwise countries, young women's life strategies have changed, they get married later and have fewer children. According to Eurostat, the population of the Enwise countries is decreasing. A negative natural growth (deaths outnumbering live births) has been registered for all the Enwise countries without exception (Eurostat, 2002). This visible trend towards negative figures of the demographic indicator *Natural increase of population* affects all sectors of public activities, including HE and R&D sectors. The ageing of the HE and R&D personnel with scientific degree is a multi-facet phenomenon with different ingredients such as low demography, policy of retirement (the pension system), policy of recruitment of young scientists, policy of scientific promotion, remuneration, public image of science and attractiveness of research careers, etc.

The ageing of the **R&D personnel** with scientific degrees is to be observed in most Enwise countries. In Bulgaria, in the academic 2001/2002 year, about **27%** of **full professors** are **60 or older** and nearly **50%** are at the **age of retirement,** and only 2.4% are under 50. The group of young scientists (until 35) is 14.5 per cent out of the total academic staff. The *research ageing* trend is also visible in the R&D sector of Romania, where, in 2000, about 60% of the total R&D personnel belonged to the age group 40-60. At the end of 1996, the average age of Latvian active researchers with scientific degrees was 54.5. In the Czech Republic, Estonia, Hungary and Slovenia, low demography combined with the shortage of funding of the GOV R&D sector, on the one hand, and the opportunities offered by the private sector, on the other hand, caused a reduction in the attractiveness of the scientific career for young talented people.

During the transitional period, HE and R&D sectors faced the following questions: ***Is it possible to replace the highly qualified academics leaving the system? How to attract talented young academics to be researchers?***

What is a *healthy* research institution… age wise?

"One research institution could be considered to be in a *healthy* situation with a promising future if the number of junior research scholars per senior scientist, exceeds 3. The present case in Bulgarian HE institutions where the ratio is less than 1.5, could be considered as catastrophic".

Source: Velev, 2002 in Sretenova 2003.

Concluding remarks

The analysis of the transformations of R&D and HE sectors in CEECs and in the three Baltic states reveals some common difficulties, which therefore can be taken to apply to all Enwise countries and summarised as follows:

- The effort for re-integration of research activities in universities, i.e. the building of R&D Higher Education sectors (HES) is rather more formal than effective, because the newly established research centres affiliated with the university departments emerged as autonomous structures in terms of state funding. These research centres allow academics to focus exclusively on research without any teaching duties. The former divide between teaching and research activities became somehow *particularly reproduced within the HES of R&D itself.*

- In HE sector, there is a move from an **elitist university system** to a **mass model**, which currently seems to affect negatively the quality of teaching and the existence of research activities within HE institutions.

- In HE sector, low demography accompanied, on the one hand, by the flow of graduates to the USA or to EU universities and, on the other hand, by the growing numbers of universities, resulted in **decreasing competition for admission to higher education** with a series of consequences.

- In R&D sector, low demography accompanied by the existing **complicated** and **outdated system for scientific promotion**, and with the loss of human intellectual capital, might create a real problem in relation to the passage to a new generation of scientists.

- In most Enwise countries, the reduction of their R&D personnel during the transitional period was about 50 per cent. From this point of view the Enwise countries face a real problem, i.e. the new EU member states are **unlikely** to be in a position **to participate fully** in the ***3% Barcelona objective*** until 2010. The expected scenario for the future of the Enwise countries is even worse. It might happen that the human resource research potential of these countries drops below the required critical mass, which would undermine their competitiveness and the very opportunity for further integration into ERA.

The *3% Barcelona objective*

In March 2002, the Barcelona European Council adopted the objective to increase the average research investment level from 1.9% of GDP today to 3% of GDP by 2010, of which 2/3 should be funded by the private sector. To reach this objective, research investment in Europe should grow at an average rate of 8% every year, shared between a 6% growth rate for public expenditure and a 9% yearly growth rate for private investment. More and adequately skilled researchers will be needed in Europe in order to attain the targeted increase of investment in research by 2010. Increased investment in research will raise the demand for researchers: about 1.2 million additional research personnel, including 700 000 additional researchers, are deemed necessary to attain the objective, on top of the expected replacement of the ageing workforce in research.

Source: European Commission, 2003d.