STEERING AND FUNDING OF RESEARCH INSTITUTIONS

COUNTRY REPORT: HUNGARY

Introduction

This paper gives an overview on the system of public research in Hungary.[1] It attempts to highlight the main characteristics of this system including the universities as well as the institutes of the Hungarian Academy of Sciences (HAS) and other newly established programmes. Hungary has a centralised research policy-making structure; public research institutions (universities and other institutions) are to a large extent still directly funded, but the share of indirect funding through competitive programmes and funds is increasing; concerning research performance there is a balance between universities and other institutions, mostly those of the HAS.

Hungary is an example for a science system of a country in transition. During the last 12-13 years the country has experienced a transition from autocratic to democratic structures, from a planned to a market-oriented economy, and from a totally top-down decision process in all policy areas to decision procedures involving stakeholders concerned. This transition has naturally had effects on the science system. It has undergone considerable reforms and change during the past few years. This paper describes the current research systems and the changes made over the last few years. It reviews the rationale and the current direction of reform. It describes the objectives of science policy, the decision structures, procedures for policy priority setting, the role of the different performers in the public research sector - an area where a lot of change has taken place with regard to the relative roles of universities and the Hungarian Academy of Sciences. It then proceeds to issues of funding and shows that the system had to cope with a considerable decrease of R&D expenditure during the 90s and has not quite recovered from these cuts. It also describes new funding schemes which are competitive and try to promote collaboration with industry. Finally, it deals with issues of human resources in which area the re-structuring of PhD training is one of the important changes. The conclusions attempt to summarise and assess the changes which have been made.

Objectives of Hungary's research policy

The Hungarian government aims at bringing both the state and the business community closer to each other since they have a role in ensuring that research, development and production are closely intertwined and placed in the service of the country’s economic advancement. To achieve this, an attempt is made to establish co-ordinated education, research and innovation policies, as well as measures to stimulate R&D activities of the private sector.

Objectives of research policy are closely linked to the subject of innovation. They have been defined in the Government Programme 2002-2006 and in the National Development Plan (NDP) 2004-2006. These

1. This paper is based on information collected through a questionnaire, the interviews conducted during a study visit to Hungary in February 2002, electronic communication with Hungarian partners, as well as other sources of information. A list of interviewed institutions is found in the Annex.

objectives are based largely on two previous policy programmes: Science and Technology Policy 2000, which outlines the long-term development programme for Hungary's science policy, and the Széchenyi Plan.[2] These objectives are the following:

- To establish a comprehensive legal framework for innovation.
- To undertake steps for Hungary to become one of the major R&D players in Central Europe.
- To strengthen IPR.
- To increase the innovation capability of SMEs.
- To support innovation at regional level.
- To increase the participation of Hungary in international S&T co-operation.
- To develop stronger R&D co-operation between public sector research and business research activities.
- To promote the development of a mobile innovative R&D workforce which is needed for a knowledge-based economy and society.
- To encourage R&D projects which contribute to increase economic competitiveness and lead to sustainable growth.
- To enhance the effectiveness of R&D activities.
- To develop the infrastructure required for efficient R&D.
- To promote quick and efficient applications of new S&T results.
- To direct capital investments toward cutting-edge fields of activity.
- To increase the use of ICT in all fields of the Hungarian economy.

It is the declared aim of the Hungarian government that science and technology policy should contribute to the basic objectives of overall policy, which are: improving the quality of life of the citizens, achieving socially, economically and environmentally sustainable balanced development, overcoming differences in regional development, establishing competitive enterprises and creating secure, well-paid jobs.

Structures for decision-making and co-ordination

The Hungarian government has recently introduced changes with regard to the structures governing S&T policy. The structure shown in the Annex Figure has become effective in 1999. It shows that a large number of stakeholders are involved and that R&D and innovation are closely intertwined.

Responsibilities for science policy-making, funding and priority setting are distributed between several authorities and levels.

The *Science and Technology Policy Council* (STPC) was founded in 1999. It is the highest level consulting and co-ordination body for the Government under the leadership of the Prime Minister. The *Science Advisory Board* (SAB), an advisory, evaluative and co-ordination body, was also set up in 1999 to support the work of the Council.[3] The main task of the STPC is to assess the country's research activities, and to define thematic priorities for research.

2. The Széchenyi Plan is a medium-term economic plan announced in 2000. In the framework of this plan, one of the most important objectives of the Programme for the Support of Research, Development and Innovation is to assist the Hungarian economy in its change to an innovation-driven economic growth model and knowledge economy.

3. The future of this Board is presently under consideration. Its role and place in the structure of governance might change.

The *Ministry of Education* (MoE) particularly its R&D Division, is responsible for the co-ordination of the Hungarian science, technology and innovation policy, for the management of the competition-based national research and development programmes and for promoting the international science and technology co-operation of Hungary. The Fund Management Directorate of the MoE was founded in 2001. It is responsible for implementing science and technology policy by managing different programmes financed within the frameworks of the National Technology Development Fund and the National R&D Programmes (see Annex Figure).

The *sectoral ministries* are responsible for mission-oriented research relating to their field of responsibility.

Priority setting

National Research and Development Programmes (NRDP) were established in 2000 which focus on the five following thematic priorities:

- Improving the quality of life.
- Information and communication technologies.
- Environmental and materials research.
- Research on agribusiness and biotechnology.
- Research on the national heritage and contemporary social challenges.

They fit into the three national priorities which were set up under the National Development Plan:

- To support strategic RTD activities jointly implemented by various stakeholders.
- To enhance human resources in R&D.
- To foster regional innovation.

Decisions on these priorities are taken by the authorities described above. However, stakeholders outside the government are involved in the priority setting process via two advisory bodies.

The National Committee for Technological Development (NCTD) is an advisory and evaluation body for the government, including the Minister of Education. It was established to work on strategies for research, innovation and technology policy. It advises on research programme priorities, and it also evaluates the annual report of activities undertaken within the framework of the National Technology Development Fund. The members of the Committee are drawn both from business, the scientific community and from government. They are appointed by the Prime Minister.

The Higher Education and Research Council gives advice to the Minister of Education concerning higher education and scientific research. It is an advisory, decision-preparatory body. MoE, The Hungarian Academy of Science, other research institutes, students, professional organisations, employers and local governments are represented in it. They are appointed by the Minister of Education.

One of the methods Hungary has used for priority setting is the *Technology Foresight Programme* (TEP). The main objective of the programme was to contribute to shaping an active catching-up strategy, using new methods and tools and involving several thousands of experts in the exercise. It provides a

comprehensive analysis of trends in technological development, market opportunities and strengths and weaknesses of the Hungarian economy in general, and the R&D system in particular.

Reasons for setting priorities are manifold. In addition to focussing on promising future areas, great emphasis was attached to aspects such as promoting interdisciplinary research and research co-operation between the public sector and industry (relevant new funding schemes are described further below).

Regional aspects also are important when assigning resources to research institutions. Hungary is faced with the situation that most of its R&D institutions are concentrated in and around the capital. In order to spread out R&D resources more evenly research institutions in remote areas receive a special bonus when applying for funds. Mixing science policy with regional policy might be a problem, since it might be to the disadvantage of scientific excellence. Geographic concentration of scientific institutions often has longstanding traditional and structural reasons and cannot be overcome by short-term funding measures.

As experience in other OECD countries shows, it may be difficult to enforce priorities and funding allocation mechanisms often prove to be the most efficient way to do so. Therefore funding for the National Research and Development Programmes (explicitly targeted towards priority fields) and the National Technology Development Fund (directly spent for priority objectives) is used for that purpose. They add up to a significant portion of the R&D budget. The MoE is responsible for managing these programmes and funds, and therefore has a major role in enforcing priorities. Other tools of innovation policy (such as regulations, tax-policy, regional incentives) also serve priority goals. However, these funding programmes are still quite new, and it remains to be seen whether they are adapted to the objective of achieving a strengthening of identified priority areas.

Role of different research institutions in the public sector

The respective role and importance of public sector research institutions have undergone major changes during the last few years. An attempt has been made to redefine the roles of research institutes of the Hungarian Academy of Sciences (HAS) on the one hand and of universities on the other. Other schemes (Bay Zoltán Foundation for Applied Research, co-operative research centres, see below) have been introduced.

The R&D institutional network of the **Hungarian Academy of Sciences**[4] is the most important public research institution. It is a research performer, but also has a role as a funding agency (see paragraph on NSFR further below). The HAS is an independent self-governed public body, its mission being to promote, support and represent Hungarian science. It has a high degree of independence in scientific, political and financial respects. Upon request, the HAS gives advice to the Parliament or the Government on any topic of science policy.

While retaining a large great degree of autonomy the HAS has undergone a number of changes during the 90s. Some of these changes were instigated by a general reform of the management of the Hungarian science system; some of them were introduced by the Academy in order to better cope with the challenges of becoming more efficient and accountable.

One of the most important changes is related to a change in the funding structure of the Academy. Today only 60% of the Academy's income is guaranteed from public sources (block grants); the remaining 40%

4. The HAS has 18 institutes for natural sciences, some of which have sub-institutions, comprising all fields of natural sciences. It has 15 institutes for social sciences and humanities, reaching from art to economics. It also has numerous research groups in all areas in the Hungarian universities.

have to be generated from other competitive government programmes or other sources. This has also led to a shift as far as research type is concerned. Formerly being described as an institution doing nearly exclusively basic research, the HAS now claims to be involved in a number of applied programmes together with industry.

Other changes relate to the structure of the Academy and to its role for the training of scientists and for defining science policy:

- In the late 90s institutes with similar R&D profiles were merged, aiming at more effective utilisation of the facilities.
- Several HAS research groups were moved to university research departments.
- The right to train PhDs and award PhD degrees has been transferred from the HAS to the universities. The HAS, however, still reserves the right to award the degree of an "academy doctor" to outstanding scientists. This is an honorary degree of high scientific reputation in Hungary. However, in practice this degree is often required for being awarded a senior scientific position, not open to “mere” PhD holders. Presently, it is even being considered to upgrade this title and give it a formal role in being eligible for full professorship at universities. This would mean that the position of the universities would be weakened, and that the HAS would regain influence in this field.
- Today, a government agency is responsible for science policy: this is the Ministry of Education. HAS as an independent public body has a very important advocacy, advisory, representative role in this area. However, according to HAS representatives the Academy is still responsible for science policy despite the establishment of an R&D Division in the Ministry of Education who officially has been entrusted with this task. Therefore the respective roles of the different players should be better defined in order to avoid inefficient duplication of action.

Universities are increasing in importance. During 1998-2000, an important integration process took place in the Hungarian higher education sector. The aim was to better cope with the growing number of students, to introduce more flexibility and diversity in the system, and to comply with long-term policy objectives of the government. Therefore the universities which were formerly compartmentalised and strongly specialised with usually rather narrow profiles of specialisation, were transformed into integrated, multidisciplinary universities. This change was made in order to render it possible to increase the number of students, to broaden curricula, and to reach an intellectually critical mass for research.

All universities are now involved in research. There are, however, significant differences between the leading research universities and other higher education institutions. This is also the reason why not all universities have been assigned the right to do PhD training or award PhD degrees (for details see chapter on “human resources”).

Higher education expenditure increased considerably between 1991 to 2001 (from HUF 5.4 billion to HUF 36.1 billion).[5] However, most of this is obviously spent on teaching since the increase is above all related to increased student numbers. The share of funds explicitly allocated for research in the institutional funding for Universities is only 4% – however, this figure does not include salaries of permanent staff, infrastructure investments and other overhead costs which actually contribute to research expenditures. This fact considered, the funds earmarked for research are low compared to other OECD countries.

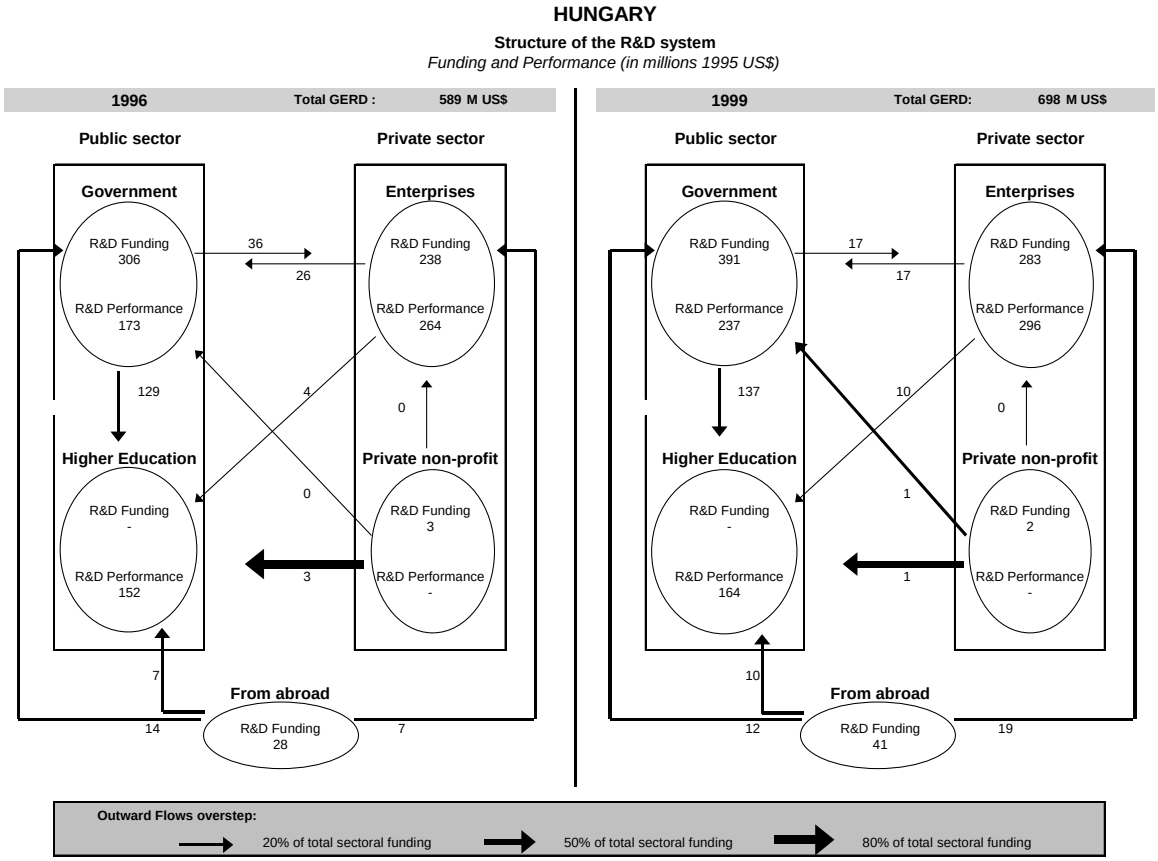
5. EUR 1 is approximately HUF 250.

Therefore research expenditures in the higher education sector has to be increasingly covered by competitive grants available for university staff.

There are some other public research institutions which are not under the portfolio of the MoE, but belong to the portfolios of other ministries and are financed out of the budget of these ministries. The Ministry of Agriculture and Rural Development, the Ministry of Environment and Water Management, and the Ministry of Economics and Transport have to be mentioned in this connection.

As Figure 1 shows government and business are the main performers and funders of research. In 1999 higher education played a less important role than the other sectors. That has changed since (see Figure 2). Between 1996 and 1999 funding, both from government and business, has increased, but increases were higher with regard to government funding. This trend continues. During the same period funding from abroad has increased by roughly 40%, due to funding from the EU Framework Programme and multinational companies. The latter also relates to the fact that business support for higher education has increased by a factor of 2.5. Up to 1999, the importance of public research institutions steadily increased in importance as compared to higher education. This trend seems to have reversed (see Figure 2).

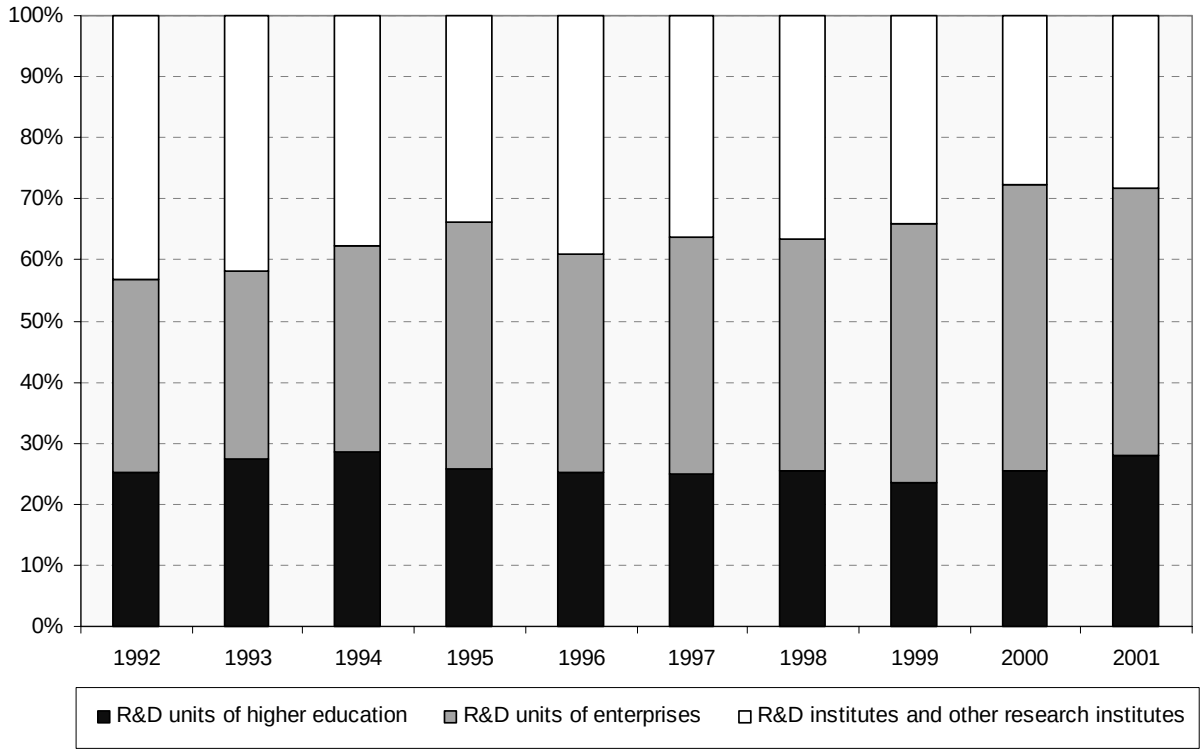
Figure 1. Funding and performance of R&D



R&D funding: All R&D funded by the sector whatever the sector of performance, and, R&D performance: R&D performed in the sector.
Source: OECD, S&T databases, July 2001.

Figure 2. R&D expenditure by sector, 1992-2001

As a percentage of total expenditures

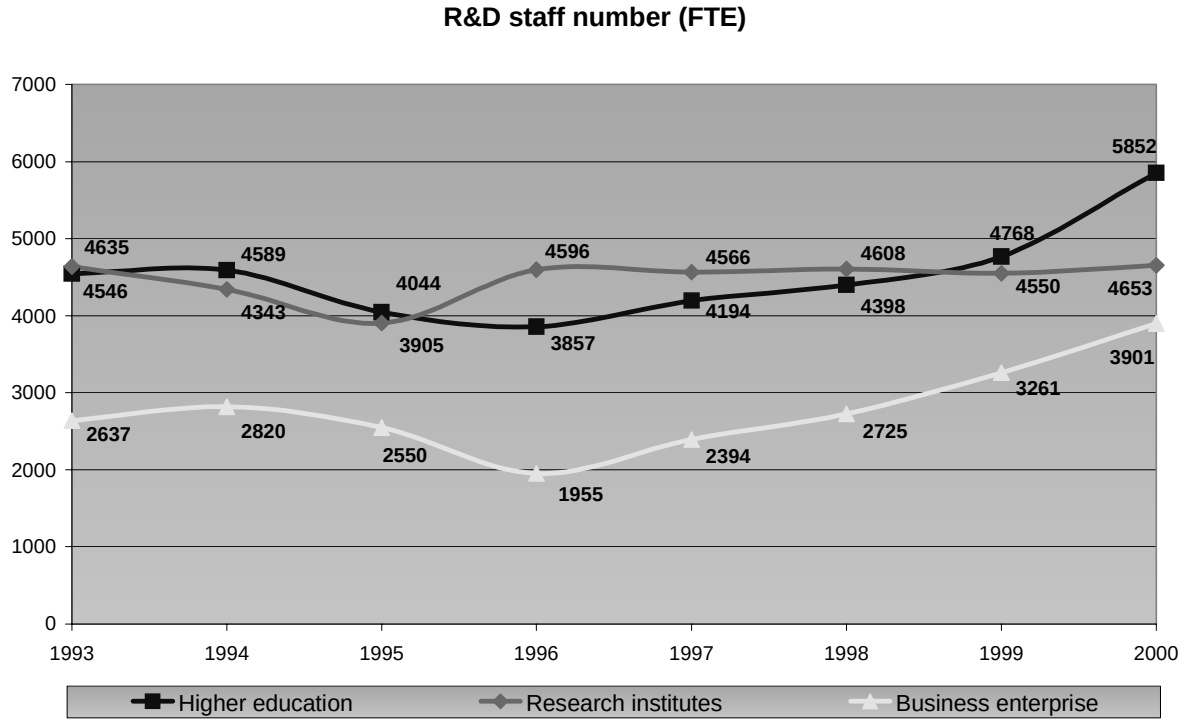


Source: Hungarian Statistical Office.

Figure 2 shows that with only 28% of R&D expenditure going into the higher education sector, this is still a weak research performer. However, in 2001 it was as important as the sector of public research institutions (PRI). For 2000 the figures were still 25% for HE and 28% for PRI, and in the beginning of the 90s the institutes were much more important than universities. It should be noted, however, that much of the R&D performed in universities is carried out in close co-operation with researchers from HAS since – in many cases – they are leading co-operative research groups inside or together with the universities.

Figure 3 shows the development of research personnel in higher education, PRI and the business sector. Whereas numbers in PRI were stable over the last five years, they increased considerably in higher education and business. This indicates that the relative importance of the PRI sector has decreased.

Figure 3. R&D staff number by sector



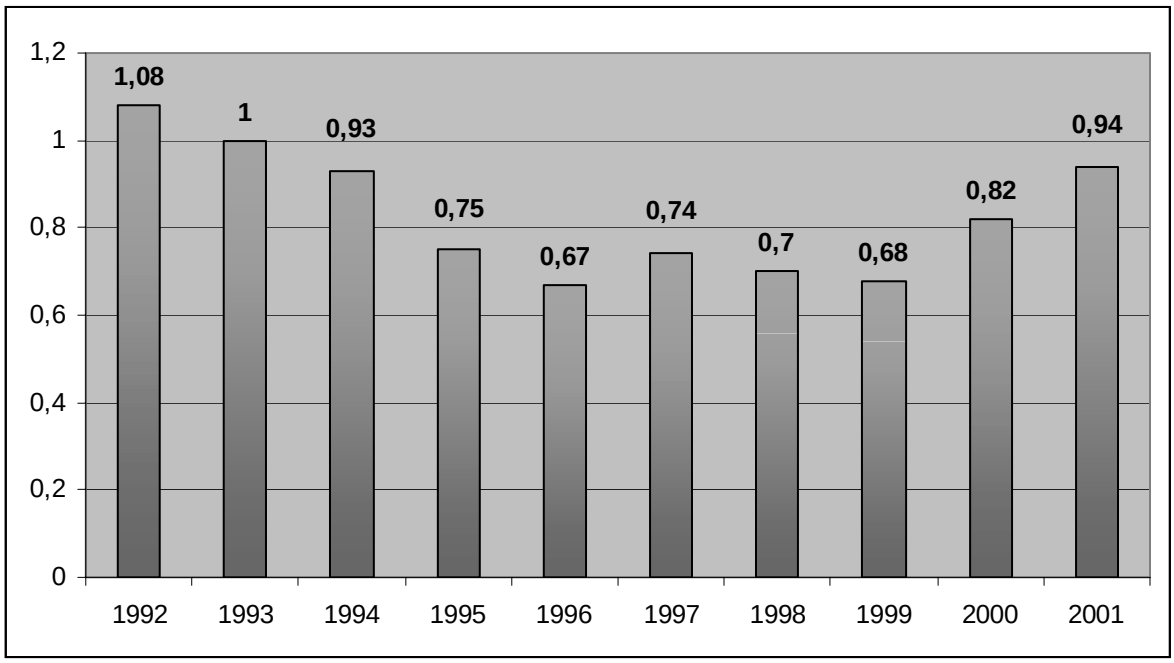
Universities and HAS institutes are increasingly looking for new funding sources from outside the government, and are therefore increasing their co-operation with domestic and international firms. (This will be described in more detail within the funding section of this report.)

The reform of the universities has clearly improved their role and efficiency. They now have the main responsibility for the training of young researchers. The merger of departments increased critical mass to do research and has strengthened the possibilities for interdisciplinary work and networking. However, the relative roles of the Hungarian Academy of Sciences and the universities for research and the training of researchers still need to be better defined. From interviews with representatives from the HAS as well as from universities an impression was gained that some of the changes outlined above have been implemented on paper, but have not been realised or accepted by the players involved. This might in part be due by the fact that the HAS could maintain some of its outstanding privileges such as a protocol status which can be compared to that of a ministry and – not least – appointment of academy members for lifetime. The latter comes with an extra honorary fee which is quite high compared to average Hungarian salaries. This status is still attractive for many scientists who would like to become academy members. They therefore have vested interests in their dealings with the Academy.

Funding levels and instruments

Funding has undergone important changes and developments in Hungary during the past ten years. This is – at least in part – related to the political changes which occurred. GERD as a percentage of GDP is still fairly low compared to most OECD countries. As a result of the substantial economic and financial challenges that accompanied the country's transition to a market economy, government expenditure for R&D dropped significantly during the 1990s (see Figure 4).

Figure 4. R&D expenditure as percentage of GDP up to 2001



Source: Hungarian Statistical Office, Research and Development 2002

After economic recovery the Hungarian government took important steps to increase R&D appropriations which is reflected by an increase in GERD/GDP to 0.94% in 2001 as against 0.68% in 1999. As Figure 4 shows is was still not sufficient to reach the situation prevailing in the beginning of the 90s. It is the declared objective of the government that GERD/GDP should reach EU average in 2006.

OECD data show that over the last 20 years industry funding for overall R&D as well as for the higher education sector has dropped considerably, showing industry funding for higher education R&D at 23% in 1981 and at around 5% in 2000. However, these data sets cannot really be compared. Different statistical methods were used, and the higher education system prevailing in 1981 was different as well. 1981 data have to be looked at in an entirely different context, since other sources for R&D in higher education were then quite limited: there were no competitive funding schemes available for university researchers; very little institutional funding was allocated explicitly for research. More recently, the government has introduced measures and programmes to strengthen co-operation between research (in particular universities) and industry and to leverage increased funding from industry for public sector research. One of the prominent examples are the Co-operative Research Centres (see Box 1).

Box 1. Co-operative Research Centres (CRCs) - a new institution with mixed funding

The CRCs are intended to be research and engineering centres located at major universities. Their objective is to develop partnerships between institutions of higher education, other non-profit research institutions and the business sector, in particular SMEs. The Ministry of Education has set aside a special fund to support the establishment of such centres. A centre can be granted between HUF 50 and HUF 250 million for an initial period of three years.

Such centres will only be supported if they are established together with business partners. They should work on a basis of mutual interest, integrating education and technology development.

Such centres can be organised in two different legal frameworks: *i)* as a legal entity totally independent of the host institution; or *ii)* within the host institutions, but separately financed and economically independent.

So far five CRCs have been selected for support[6]. They started operations in 2001.

Observations: Interview partners both in the Ministry as well as in the university welcomed a closer co-operation with industry, but were rather sceptical with regard to the above described funding scheme. Several problems were identified: The legal structure was regarded as being difficult. So far SMEs were not involved to the degree expected. Business had too much influence on the formulation or re-formulation of R&D strategies of host institutions as well as on research training curricula. The scheme might prove to be successful after an initial period. However, three years seem a short time for really getting such centres established. Though grants can be prolonged after this period, it is not quite clear what criteria have to be met in order to be granted such prolongation.

Another major change relates to the fact that public funding is increasingly based on competitive funding instruments. Most of the expenditure increases during the last few years were spent on the competitive funding programmes described below (with the exception of salary increases, see section on "human resources").

There are three major sources of funding for competitive programmes (for figures see Table 1):

National R&D Programmes (NRDPs). They have been introduced in 2001. Their aim is to support large-scale research, development and innovation projects, focus on interdisciplinary approaches and bridge the gap between basic and applied research. Special attention is given to projects implemented by consortia of several partners comprising the higher education sector, other public R&D institutions and industry. One third of the project costs should always be leveraged from industry.

National Scientific Research Fund (NSRF). It was first established in 1986, supervised by the HAS. In 1991 it became an independent funding authority. Its aim is to support basic research, leading to the discovery of new scientific rules, accumulation of new knowledge methods and procedures, and provide for the infrastructure required for the achievement of scientific results.[7] As with funding authorities of such type in most OECD countries, funding is based on calls for proposals with an ex ante peer review. Funding concentrates on thematic programmes, with a special focus on young researchers, on scientific equipment, on post-doc support (for projects in Hungary only), on the support for libraries and electronic databases as well as on conferences and publications. Funding does not include salaries or other institutional support and support for overheads is very low. Presently, 50% of the expenditure is directed to universities, 30% to HAS institutes, and 10% to public collections and other activities. During the interviews specific concern was encountered with regard to the NSRF (OTKA). Levels of individual grants are regarded as being sub-critical in most cases, and the agency is being judged for spreading its

6. Budapest University of Technology and Economics - Inter-university Communication CRC.
Semmelweis University - Rational Active Agent Laboratory.
Miskolc University - Laboratory of Mechatronics.
Pécs Science University - CRC for South Danube Region.
Veszprém University - Chemical Laboratory for Sustainable Chemistry. This choice shows that regional aspects were a selection criteria among others.

7. Section 1 (2) of the law providing the legal basis for NSRF.

modest budget too widely instead of concentrating on scientifically excellent projects.[8] This seems particularly important regarding the fact that despite increases in the funding volumes for the NSFR in 2001 (in USD equivalent), funding is still a third less of what it used to be in 1993 (1993: USD 27.8 million, 2001: USD 18.1 million).

National Technology Development Fund (NTDF). Objectives of this fund are to support technological innovation, the development of R&D infrastructure, the dissemination and economic application of research results, and to support priority areas and innovation policies. The programmes of the Fund finance applied research and experimental development projects focusing on generic technologies (biotechnology, environmental technologies, ICT), as well as enabling/network-building activities carried out in co-operation with other (public or private sector) partners. The projects are intended to contribute to sustain economic competitiveness.

Table 1. Volume of the three major Hungarian R&D programmes, allocated resources

	1999 (HUF 1 billion)	2000 (HUF billion)	2001 (HUF billion)	2002 (HUF billion)
National Scientific Research Fund	2.5	3.1	4.2	5.4
National Technology Development Fund	5.1	6.3	8.75	10.94
National R&D Programmes	0	0	5.572	10

Other examples for new funding schemes in the Hungarian science system are the Bay Zoltán Foundation for Applied Research (see Box 2), and six centres of excellence funded by the European Commission. Of the latter 5 belong to the HAS, one is an independent institution, the Collegium Budapest, Institute for Advanced Study, which deals mostly with subjects related to the social sciences.

8. In September 1997, William Blanpied, NSF and former chair of the OECD Group on Science Systems, wrote in an article entitled 'Science in Hungary: Managing a System in Transition Jewel': "OTKA has been overly concerned with equity at the expense of excellence to manage an effective, competitive grant systems." This still seems true in 2002.

Box 2. Bay Zoltán Foundation for Applied Research

The Foundation was established in 1992 by the then National Committee for Technological Development (now the research and development division in the MoE). Its purpose is to carry out efficient applied technological and scientific research and development. One of its major objectives is to establish an intellectual basis for an emerging small and medium-sized Hungarian business sector. Other objectives include the establishment of demonstration centres for teaching modern industrial and agricultural methods and the training of researchers, supplementing the universities' PhD programmes.

The Foundation operates as a non-profit organisation. It obtains its financial resources from the interest on financial investments from a fund first established by the government, from R&D and service contracts concluded with business and from international funding programmes.

Activities are carried out in three research institutes established by the Foundation: the Institute for Materials Science and Technology, the Institute for Biotechnology, the Institute for Logistics and Production Systems.

The Bay Zoltán Foundation is considered a very important, permanent, and integral part of the Hungarian R&D system, unlike Co-operative Research Centres which are just a single grant scheme, funded from NTDF.

Observations: It is difficult to get an impression about the Foundation's achievements. Though the income from R&D projects has increased considerably over the last five years (from around HUF 100 million in 1996 to around HUF 250 million in 2000), financing of the Foundation is not guaranteed according to MoE representatives. With a total income of approximately HUF 605 million in 2000 and a staff total of 85, comprising researchers, technical staff and other support staff, for all three institutes, the question arises whether there is enough substance for a critical mass. Linking one of the major aims of the Foundation – producing marketable research results – to the patenting activity of the Foundation, it has to be stated that much remains to be done in this sector: in 2000 the Foundation had only three registered patents, and 12 others in the application process. Obviously none of these patents has been licensed so far.

Funding from abroad

According to data from the Hungarian Central Statistical Office about 10% of total GERD in Hungary came from abroad in 2001. Supposedly, most of this is coming from the EU Framework Programme in which Hungary is participating as a full member. The Hungarian contribution to the Framework Programme has to be paid out of the MoE budget (in most EU countries contributions to the EC are paid out of the budget of the finance ministry). At present, 5% of the MoE budget is spent on this purpose. At present, the Hungarian contribution to the EU and total funds awarded to Hungarian institutions by the EU are approx. at equal level. It might be considered to pay the Hungarian contribution to the EU Framework Programme out of the finance minister's budget. This would release financial resources in the MoE budget for other purposes.

Since the transition to a market economy Hungary has made enormous efforts to achieve a funding level sufficient to maintain a viable science system. These efforts should be continued. It has also introduced new competitive funding schemes, which – to a large extent – aim at strengthening the links between science and industry. These are certainly measures going in the right direction. However, the introduction of new funding schemes and the simultaneous maintenance of traditional funding instruments such as institutional funding leads to underfunding in many fields since overall funding is still low compared with

other countries. Also, there is a concern that competitive funding will – in the long term – neglect the support for basic research (in a broad sense, not in the narrow Frascati definition).

New registration system of Hungarian R&D

During the last few years it has become evident in Hungary that publicly financed research has to be properly documented. It became one of the objectives of governmental R&D policy to create a powerful tool for such documentation. Therefore, a new documentation system for Hungarian R&D is presently being established: the Register of National Research Activities. It has the following objectives: *i)* increase the transparency of funding, *ii)* avoid duplication of funding, *iii)* facilitate networking between researchers and research institutions and the search for research partners, *iv)* facilitate international co-operation, *v)* facilitate long-term planning of research, and *vi)* accelerate innovation of new technologies.

This new online database will provide an in-depth overview on the results of Hungarian R&D. All publicly funded research units are obliged to provide information on all R&D projects, being supported by the state budget. In addition, the Register will be open to every research unit dealing with R&D. The related technical work and supply (*e.g.* collecting and putting information on computer) will be performed by the National Technical Information Centre and Library of the Technical University of Budapest. Evaluation and analysis of the provided information will be carried out by the R&D Division of the Ministry of Education.

The establishment of this Register has already started. However, the required infrastructure will only be installed step-by-step. The collection of information is not yet fully done on an on-line basis. Though there is a general opinion that the cost-efficiency of the Register will be quite good, because a low amount of money is needed to create and run it, there is also an opinion claiming that considerable funds will have to be made available if the Register is to achieve the objectives outlined above.[9]

Evaluation

Common ex-ante and ex-post evaluation methods are being used in Hungary. This is particularly the case for R&D funding for the higher education sector and the funds allocated via the NSFR.

In the field of HE R&D programmes, the MoE has established ex-ante evaluation procedures as a basis for decisions on how to allocate available resources. The amount of institutional funding (normative research support) is based on quantitative indicators such as the number of teachers and researchers having a PhD degree, on the volume of research activities of the universities and on the number of PhD schools and students. Regional criteria also are applied for decisions on funding in order to support regional universities as compared to HE institutions in Budapest where most of the country's R&D institutions are concentrated.

As for the new competition-based R&D funding programmes, managed by the NTDF, evaluation and assessment activities began in 1995. These evaluation exercises concern whole programmes over a certain

9. A similar register does exist in the United States. It is run and managed by a semi-private institution (RAND Corporation) with the support of the US government and the National Science Foundation. In the US there has been some discussion about the usefulness and the cost-efficiency of this register. Hungarian managers of the register might want to contact RAND to discuss experience with this kind of register (to be found on the RAND website www.rand.org under "Science and Technology", RaDiUs). It should be noted, however, that RaDiUs comes with a heavy fee for non-government users, it is targeted towards US government purposes, whereas the Hungarian system will be open to all users.

period of time (five years as a rule). Evaluation focuses on the direct and indirect impact of research projects and the programme as such on the economy as well as on more general question related to science policy. The first R&D programme evaluation which was carried out with the help of Swedish experts in 1995-96, concerned the largest NTDF programme, the Programme for Applied R&D. Further evaluations dealt for example with the Export Development Programme, Hungarian participation of the European COST actions and EUREKA projects, on the efficiency of the liaison offices fostering Hungarian participation in the EU 4th and 5th RTD Framework Programmes (2001), the programme for promoting Hungarian participation in foreign exhibitions (not directly related to research, but to innovation), and an evaluation of NCTD policy to support SMEs. In this connection it should be noted that one of the most important quality criteria for evaluating R&D in Hungary is how successful programmes have been in bridging the gap still existing between Hungary and EU member countries. In several cases programmes rules were modified due to recommendations made during the evaluation.

Experience does not yet exist with evaluating new funding schemes such as Co-operative Research Centres and the Bay Zoltàn Foundation (see Boxes 1 and 2). In both cases clear criteria need to be established yet for a prolongation of the funding period.

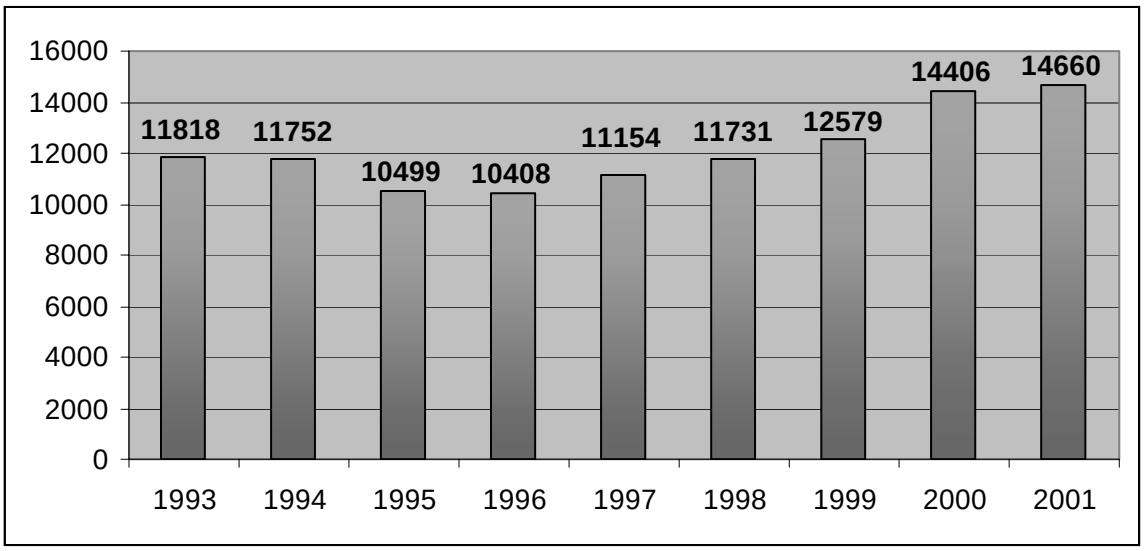
Hungary has made considerable efforts to establish new evaluation procedures, also with the support of international experts. It seems that the country's most important concern is to prove that it is on the right track towards the EU. However, the Hungarian government should also take into account specific Hungarian strengths which might deviate from the European mainstream (*i.e.* related to the priority area "cultural heritage"). It should further be kept in mind that science institutions need a sound basis for mid-term and long-term planning. They should therefore be precisely told what the evaluation criteria are, what results are expected, and what the conditions for continued funding look like.

Policy changes relating to the management of human resources in R&D

During the first half of the 90s, in parallel with the decrease of GERD, the total number of researchers also decreased considerably in Hungary. It increased again between 1997 and 2001 (see Figure 5). However, this increase was due to an increase in the number of researchers in industry (see Figure 6), mostly in Hungarian affiliations of international companies. Therefore major policy objectives of the Hungarian government in this area were to increase the number of students at universities, to increase the number of PhD students, to increase the number of researchers in the public sector, to stop "brain drain" from science to industry[10] and from Hungary to abroad.

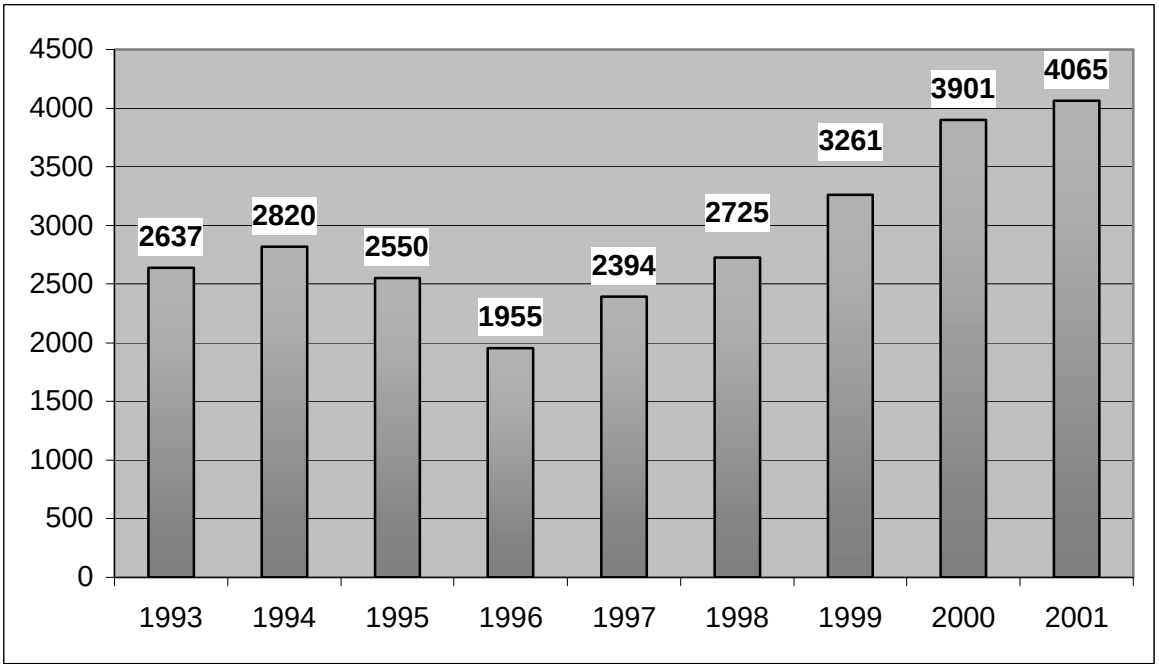
10. Very often researchers going from science to industry leave the science system completely, since they are not working as scientists in industry.

Figure 5. R&D staff numbers (scientists and engineers), FTE



Source: Hungarian Statistical Office, Research and Development 2002.

Figure 6. Staff numbers (scientists and engineers), FTE, in R&D units of enterprises



Source: Hungarian Statistical Office, Research and Development 2002.

Major efforts have been made to achieve the above-described objectives. Student numbers grew considerably, from 12% of the age group 18-22 in 1991 to 28% of that age group in 1999, and it is planned to raise this ratio to about 50%. The absolute number of students in the higher education sector was around 108 000 in 1990 and around 305 000 in 1999.

The most important development in Hungary in this sector was the restructuring of PhD training, including the establishment of "PhD schools" at the universities which took place in 1993 (see Box 3). From 1993 to 2000 the number of PhD students has increased constantly. It was around 8 000 students in 2000.

Box 3. PhD Training

After the right to train PhD students and award such degrees was transferred from the HAS to the higher education sector (see paragraph 16), PhD training was considerably restructured in Hungary. Before, preparation for this degree was very unstructured, clear regulations were missing, although scientific and academic requirements were the same as today. In order to give PhD training a clear regulatory and structured framework, important reforms were introduced:

- School-based studies were introduced for preparing a doctorate degree (PhD schools). Each university faculty can have its own doctoral programmes, but these have to be accredited by the Hungarian Accreditation Committee (an independent advisory body). Presently there are more than 300 such programmes in Hungary.

- Doctoral education in Hungary is now a three-year programme. Applicants have to fulfil precise requirements (good university study results, foreign language knowledge), and they have to pass an entrance exam to participate in such programmes.

- After having been admitted PhD students can chose between different basic forms of doctoral education: *i)* full-time student with a state scholarship, *ii)* full-time student without a state scholarship, *iii)* part-time students[11], and *iv)* students preparing themselves individually for the doctoral degree. The latter are a minority in this scheme.

- Procedures to be awarded a doctorate degree are organised in two phases: *i)* A three-year training during which each student (with the exception of those preparing individually for the degree) has to participate in such courses prescribed by the tutor or the programme and collect course credits, *ii)* the degree-awarding process for which the following requirements have to be fulfilled: completed training, medium-level proficiency – proven in state-recognised exams – in two foreign languages, original scientific work based on publications and a written thesis. In addition students have to pass two oral exams to be awarded the degree.

The above-described changes were introduced in order to increase the scientific quality of PhD training. Efforts related to these changes have been considerable, in particular financial efforts. In 1999 about 4 300 students received a full-time scholarship (which is higher than the average Hungarian salary). This has been an important incentive for students to continue their studies with the aim of achieving a doctorate degree.

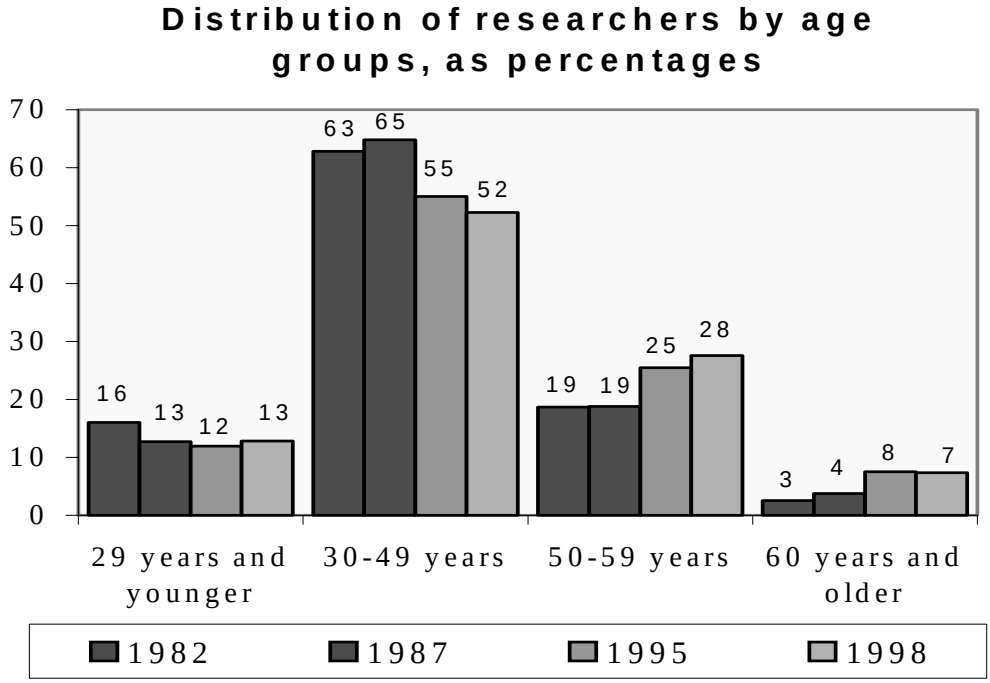
The strictly school-based doctorate training seems unusual compared to the system of doctoral training in other OECD countries. While it is obvious that students have to acquire general knowledge and excellence, there might be a danger of neglecting independent creative research since – looking at the prescribed time frame – there seems to be little room for this within a period of three years.

Major efforts have been undertaken to increase the number of researchers in the public sector and to retain them there. One of the main reasons being the alarming increase in the average age of researchers and faculty members (see Figure 7). Another reason is that few people move from the business sector to the institutions of HE and HAS. On the other hand, many public researchers flow into the public sector in order to get a higher salary, to work with better research equipment and to enjoy a more comfortable

11. The most important group among part-time students is the teaching staff of higher education institutions. They usually work full-time as teachers while – at the same time – attending doctoral schools and conducting their own research work within a PhD programme.

environment. A new career model has been introduced giving more support and incentives to younger researchers. Most importantly, salaries for public sector researchers have been increased in order to reduce "brain drain" to industry or other countries. In the new salary scheme, basic minimum salaries are defined by the government, but individual institutions are autonomous to pay higher salaries according to the availability of funds and to the achievements of individual researchers. However, institutions – *e.g.* the HAS – state that not enough funds would be available to use this opportunity.

Figure 7. Age distribution of R&D staff



Another measure for making research work in public institutions more rewarding has been to establish close contacts between higher education institutions and the business sector. Some examples:

- R&D labs of firms are established at universities or in close co-operation between R&D units of firms and university labs (Ericcson, Nokia, Westel, Sony, Knorr-Bremse at the Budapest University of Technology and Economics; EGIS lab at the Semmelweis University; Volkswagen lab at the University of Miskolc).
- Jointly selected Ph.D. projects supported and co-funded by firms exist at practically all universities.
- A few months (6 months maximum) on-the-job training for students organised jointly by firms and higher education institutions.
- Joint curriculum development between universities and business.

According to interview partners in Hungary measures in the field of human resources management have been successful to reduce "brain drain" to abroad. Increased pay in public sector research and better research conditions have retained Hungarian researchers in Hungary. Other programmes to attract foreign

researchers to come to Hungary have been successful, in particular with regard to researchers from other Central or Eastern European countries. However, such measures could not yet stop researchers moving from the public sector to the private sector. Therefore the major problem remains to keep highly qualified researchers in public research institutions.

Summary conclusions

Hungary has made considerable efforts to reach the goals mentioned earlier in this report. It has made changes in structuring and governing its science system during the period of transition to a market economy which are remarkable and point in the right direction. The system has become considerably more pluralistic and more decentralised while – at the same time – government structures were introduced to guide and monitor it. Very often institutions and structures in EU member countries have been taken as a model. This is very understandable since Hungary's overall policy objective is an accession to the EU as early as possible.

Despite the positive overall trend in managing the science system, the Hungarian government still faces some problems related to changes in the structure and in the funding of the Hungarian science system. A balance will have to be drawn between different players in the scientific community. Though consensus should be sought as often as possible, this is not always easy. There will always be parts of the system which will not be satisfied. Therefore a courageous policy is required in some cases. Some major concerns to be considered are outlined in the following paragraphs.

A very positive feature of the changes implemented so far is the strengthening of the universities in R&D. However, much of the increased funding is spent on teaching due to enormously increased student numbers. The government's recent decision to introduce two cycle-studies in compliance with the Bologna process of the EU might help higher education institutions cope with this problem. It might also be considered to concentrate undergraduate studies in teaching universities and graduate studies, PhD training and research in research universities. In this connection the different roles of HAS institutes and universities might also be more clearly defined. Despite the strengthening of the universities the major part of fundamental research still takes place in HAS institutes. If this is an objective, this should be clearly specified and the HAS be given the appropriate funding and autonomy.

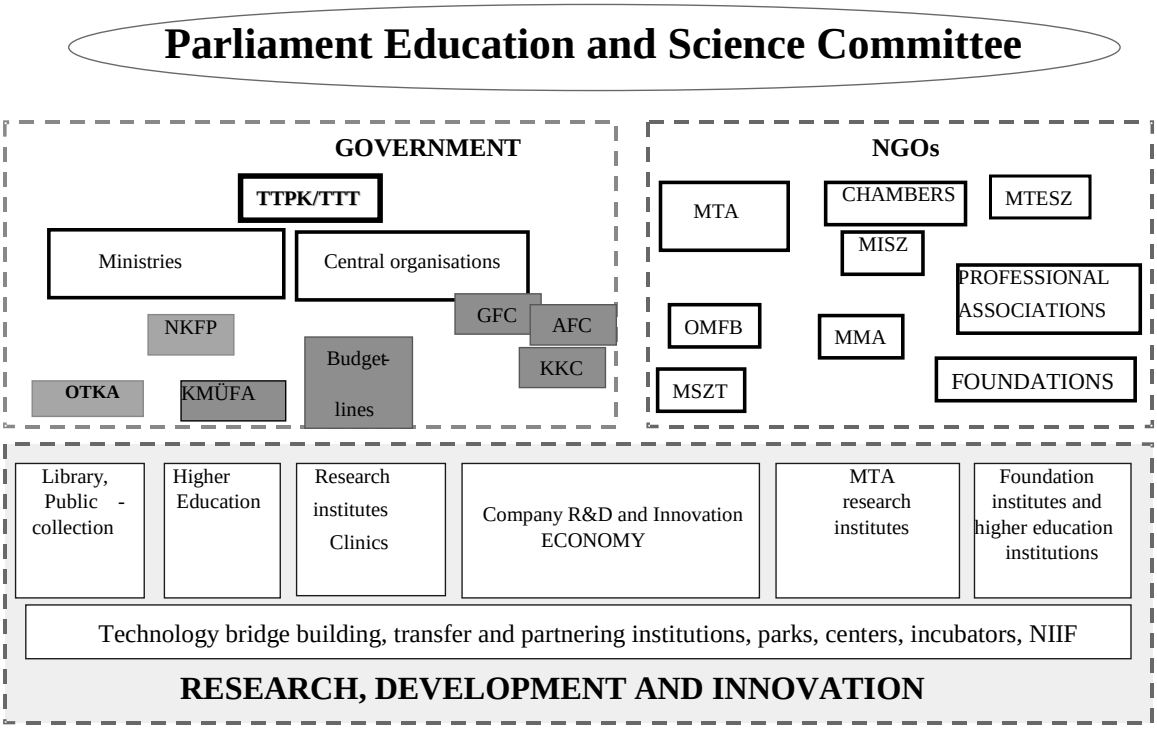
Though funding has increased over the last few years, it has still not reached the level of 1991 (in US Dollars). At the same time a number of new funding schemes have been introduced and researchers'salaries have been increased considerably. This underfunding causes above all two problems: First, the new funding schemes (such as described in Boxes 1 and 2) are in competition with older institutions. These older institutions often find it hard adapt to new funding schemes and face new competition. Since they were also often engaged in basic research, there is a growing concern that basic research will decrease in the end since no direct link with innovation can be shown for such research, though figures show that basic research does not seem to suffer and its percentage of GERD is even increasing (see Para. 29). Second, those new funding schemes which are created by government grants for a limited period of time, have to start with very little financial resources. Very often their continued funding after an initial period of two to three years is not guaranteed. This seems to be very short to really prove that achievements with such new schemes can be made. On the other hand, it also has to be taken into account that the Hungarian government is concerned about the lack of performance in the fields of experimental development and economic utilisation. A statement which is strongly supported by the fact that indicators for publications are good (about 45-50% of the EU average calculated on the total population, much better if calculated on the number of researchers), and that indicators for patenting lag much behind (2% of EU average in EPO patents, 4% of EU average for USPTO patents).

Hungary has to be complimented on its efforts to strengthen links between science and industry which are currently much weaker than in most OECD countries. However, a balance has to be struck between interests of public sector research and business interests. There is a growing concern that business has too much influence on some institutions of public sector research, in particular in some universities research and training curricula seem to be totally dependent on industry. Though, it has been acknowledged that one of the dominant needs in Hungary is public/private partnership building, it has to be assured that the pubic interest is also satisfactorily taken into account. Another concern in this field is the little activity with regard to the licensing of patents. Patent registration has increased over the last few years, but it is still much lower than in the early 1990s. The recent modification of the patent law tries to remedy the situation. Institutions as well as individual researchers can own patents. Very often patents are opened without any licensing. Technology transfer offices do not exist in HAS institutes, and there are very few in universities.

Despite the efforts to attract young researchers to the public research system, concerns remain with regard to the question whether enough of the new student population will chose to stay in the science system. This concern is above all linked to the fact that Hungary has an ageing researcher population (in 1998 35% of researchers were over 50). So far, Hungary does not have any measures to improve the representation of women in the science system. Here might be a potential which could be tapped (44.5% of PhD students are now female). However, this might mean changing the attitudes in some of the institutions concerned.

ANNEX

Hungarian research and development system



"Central organisations" are non-ministerial government agencies having a role in R&D such as the Hungarian Patent Office, the Hungarian Office for Measures, the National Geographic Survey, the Hungarian Central Statistical Office. MTA research institutes are such institutes of the HAS not located in a higher education institutions. For other acronyms see list below.

NGOs in this graph are perceived as any organisation, even if funded publicly, which is not controlled by any government entity, but is independent in its decisions. This includes the Hungarian Academy of Sciences.

ACRONYMS

EU	European Union
GERD	Gross Expenditure for R&D
GFC/AFC/KKC	Funds managed by the Ministry of Economics to support economical development/job creation/SMEs
HAS	Hungarian Academy of Sciences
KMÜFA	see NTDF
MISZ	Hungarian Association for Innovation
MMA	Hungarian Academy of Engineers
MoE	Ministry of Education
MSZT	Hungarian Standards Institution
MTA	see HAS
MTESZ	Federation of Technical and Scientific Societies
NCTD	National Committee for Technological Development
NDP	National Development Plan
NIIF	National Information Infrastructure Development Program, an independent program supported by the government budget, with an independent office
NKFP	see NRDP
NRDP	National Research and Development Programmes
NSRF	National Scientific Research Fund
NTDF	National Technology Development Fund
OECD	Organisation for Economic Co-operation and Development
OMFB	see NCTD
OTKA	see NSRF
TTPK/TTT	see SPTC/SAB
STPC/SAB	Science and Technology Policy Council and Science Advisory Board

INSTITUTIONS VISITED IN BUDAPEST, 12-15 FEBRUARY 2002

Ministry of Education:

Department for R&D Strategy
Department for R&D Statistics and Indicators
Department for International Affairs
Department for Higher Education Programmes
Department for Higher Education development and Evaluation

Register of National Research Activities (National Technical Information Centre and Library)

National Science Research Fund

Budapest University of Technology and Economics

Hungarian Academy of Sciences (Department for International Scientific Relations)

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