SCIENCE AND TECHNOLOGY POLICY IN HUNGARY: PRESENT STATUS AND BREAKTHROUGH POSSIBILITIES

Report of the Science and Technology Policy Advisory Board 2004[1]

Budapest
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PREFACE

The main aims of the Science and Technology Policy Council (TTPK[2]), which was set up in mid-2003, are to address conceptual issues concerning scientific research, technological development and innovation, as well as to elaborate Hungarian science and technology policy in context with social and economic policy, and to prepare relevant decisions for the Government. The Science and Technology Policy Advisory Board, helping with advices, evaluations and co-ordination, contributes to the work of TTPK.

Hungarian R&D and innovation sector has been unable to meet the objectives of successive governments for the past fifteen years. The present situation is rather disturbing. The past fifteen years were characterized by spontaneous transformations, hasty implementation and abolishment of superficial measures and a total lack of continuity and transparency. The situation is even graver if we consider the fact that since 1990 the sector's institutional framework has constantly been changing, which unequivocally hindered the integration of R&D policy into the mainstream administration, its effective implementation and the sector's participation in decision-making mechanisms of governments.

Based on the experiences and debates of the past two years, we give a detailed overview of Hungarian R&D and innovation in our report, which was approved by TTPK in June 2005. Apart from the 'diagnosis' of the sector we also depict its international background, its main links, and based on these we present strategic ideas, which might help revealing breakout points.

We believe that political and social recognition, consensus is needed which is able to integrate innovation – complying with the requirements of a knowledge-based society – into the process of modernisation as the main driving force of long-term development of economy and society. The elaboration and implementation of professionally well-founded science and technology policy, reaching over several terms of administration and accepted by political parties, are necessary. This is the joint responsibility of successive governments, politicians, professionals and relevant stakeholders.

With the present report we wish to start a series of annual reports. As the first step we tried to analyse the situation and raise questions, which already contain parts of the answers in an

[1] Original members at set-up: László Somlyódy (president), Miklós Boda, Erik Bogsch, László V. Frenyó, László Keviczky, Imre Kondor, Ádám Kondorosi, István Lepsényi, József Mandl, Pál Tamás, György Varga. Three of them left the Board at the beginning of 2004 (Miklós Boda, László V. Frenyó and Ádám Kondorosi), due to their career-moves and permanent residency abroad. New members, Zoltán Bedő, Gábor Bojár and Tibor Vámos, were appointed in 2005.

[2] Tudomány- és Technológiapolitikai Kollégium (TTPK)

embryonic form. Our aim was to generate debate in order to help develop interaction and set up paths for necessary changes.

Budapest, June 2005

László Somlyódy
President of the
Science and Technology Policy Advisory Board

EXECUTIVE SUMMARY

Technology and innovation performance became a key element of economic growth in developed countries in the past 10-20 years. This general trend, however, was not, or hardly reflected in the economic policy of Central and East European countries – including that of Hungary.

Several positive measures have been implemented under the present administration. The Act on the Research and Technology Innovation Fund, as well as the Act on Research and Development and Technological Innovation were passed, and the National Office for Research and Technology (NKTH[3]) responsible for implementation was set up. The importance of these measures lies with the fact that – for the first time since the transition to democracy – R&D and innovation policy became free of the traps of the annual budget-fights enabling long-term financing and planning in the sector.

The abovementioned measures, on their own, are far from being sufficient to increase Hungary's competitiveness at the required rate. Indeed, the R&D sector has been unable to meet the objectives of successive governments for the past fifteen years, thus the present situation is more than disturbing. The R&D sector struggles with the legacy of the transition period, which was characterized by spontaneous transformations, hasty implementation and abolishment of superficial measures and a total lack of continuity and transparency. The situation is even graver if we consider the fact that since 1990 the sector's institutional framework has constantly been changing, which unequivocally hindered the integration of R&D policy into the mainstream administration, its effective implementation and the sector's participation in decision-making mechanisms of governments.

We give a detailed overview of Hungarian R&D and innovation in our report. Apart from the 'diagnosis' of the sector we also depict its international background, its main links, and based on these we present strategic ideas, which might help revealing breakout points. We did not limit our report to the appraisal of overused and restraining indicators (like R&D expenses measured against GDP and the ratio of public/private R&D expenditure). Using international surveys we strive to depict a more detailed picture focusing on those aspects in which Hungary is lagging far behind. This scrutiny will reveal some paths required for catching up or find the right 'therapy'.

Based on the analyses our conclusions and recommendations follow.

[3] Nemzeti Kutatási és Technológiai Hivatal

(1) What should be done? Political and social recognition, consensus is needed which is able to integrate innovation – complying with the requirements of a knowledge-based society –into the process of modernisation as the main driving force of long-term development of economy and society. Professionally well-founded science and technology policy, and a coherent strategy, reaching over several terms of administration and accepted by political parties are necessary, as well as their consistent implementation. There is no need for fragmented programmes, which rarely strengthen each other's impact. This is the main "message" of this document.

(2) The total R&D expenditure in Hungary was 0.95% of the GDP in 2003. The share of the business R&D expenditure of the GDP was extremely low, only 0.38%. The realistic target in the next 5 years seems to be the increase of R&D expenditure (measured against GDP) by 0.10 - 0.15 percentage points annually, at least 2/3 of which should come from the business sector. This would only be the first step in catching up with the EU-15 average (1.98% and 1.3%), which itself is lagging far behind the Lisbon target (R&D expenditure: 3% of GDP, 2/3 of which should be funded by the business sector).

(3) Education, science and technology policies should be synchronised in order to represent innovation interests. The "win-win" cooperation of key stakeholders (research institutions and units, universities, spin-off companies, small and medium-sized enterprises, etc.) having common interests should be ensured by smart programmes, incentives and adequate financing mechanisms, as opposed to the present practice of segregation and unwanted clashes. Short-term tasks, which have favourable impact on innovation activity, should be examined on governmental level and on the basis of these, strategic goals should be set up. The first step of the "therapy" should be the well-considered creation of government regulations to ensure the implementation of the act on innovation (see Government Decree Nr. 2286/2004. (XI.17).

(4) The basic issue of the Hungarian innovation policy is the strengthening of the weak supply and diffusion (knowledge flow). It is obvious that the increase of public expenditures on its own leads to a "dead-end". It is essential to strengthen the domestic business sector and to increase its risk-taking capability.

(5) Domestic small and medium-sized enterprises (SMEs) should receive a favourable treatment. Elaboration of a government strategy aiming at the development of innovative SMEs is one of the most urgent tasks. Public funding should not only serve as capital substitute, but also as a stimulating factor for innovation activity forming an integral part of the tax and monetary policies. The Hungarian economic growth cannot be exclusively based on the change of investment attitude of international enterprises in the long run.

(6) Technological innovations can only be successful if enterprises introduce all the necessary structural, management and market, etc. innovations. The creation and development of regional networks strengthening diffusion as well as incubation systems hosting innovative enterprises in knowledge centres should be promoted by public instruments. This is the prerequisite of the exploitation of targeted basic research as an integral part of the innovation chain.

(7) Restrictive legislation preventing pension funds and insurance companies from investing in venture capital funds should be revised. Risks could be decreased by combining public and private capital. Support mechanisms with public financial commitment should be introduced to make projects more attractive for private capital.

(8) Responsible modernisation policy is needed, which is committed to innovation and sets up and operates an institutional system, which can help governmental decision-making and delivery with adequate "reflection" capabilities. The analyses needed (technology impact assessment, collection and analyses of R&D and innovation statistics, technology

foresight, systemizing of institution- and programme assessment) could ensure correct political decisions.

(9) Fundamental financing and legal obstacles should be demolished and predictability should be guaranteed. Public financing of R&D should not be the residual element of budget-policy.

(10) The huge number of on-going programmes with public financing should be screened and evaluated urgently, and only those should be continued which are the most efficient on the one hand, and those which best comply with the innovation policy objectives defined on the basis of the present analysis. The tender system should be transparent, red tape must be cut, and independent bodies should perform monitoring tasks. Priorities must be set, topics should be concentrated and fragmentation of human and financial resources must be avoided. The number of researchers per topic should be raised (from less than 1 person / topic) to over the critical level necessary for efficient operation.

(11) Success in innovation should receive bigger publicity; public awareness should be raised concerning the importance of R&D in the improvement of quality of life.

INTRODUCTION

1. Technology and innovation performance became a key element of economic growth in developed countries in the past two decades. This general trend, however, was not, or hardly reflected in the economic policy of Central and East European countries. Their different growth-path in the 90's can be explained by their different pristine conditions, reform-strategies and ability to attract capital.

2. The "two-tier or multi-tier Europe" debates of the past years were about political will for integration and about possibilities to reduce disparities. A two-tier Europe already exists in the differences in the innovation capacities of member states, although there is a relatively high number of researchers and the rate of qualified labour force is adequate in Central and East European countries including Hungary.

3. Following a one-year preparation period, the present administration set up the Science and Technology Policy Council and the Science and Technology Policy Advisory Board in the summer of 2003. These bodies had already existed prior to this date under different names. Several positive measures have been implemented under the present administration. The most important measures include: the Act on the Research and Technology Innovation Fund, the Act on Research and Development and Technological Innovation, and the transformation of R&D and innovation governance system (by setting up the National Office for Research and Technology NKTH[4], Research and Technology Innovation Council and Agency for Research Fund Management and Research Exploitation). The importance of the abovementioned two acts and the transformation of the governance system lies with the fact that – for the first time since the transition to democracy in 1990 – these measures make R&D and innovation policy free of the traps of the annual budget-fights and they enable long-term financing and planning in the sector.

[4] The first annual report on the activity of NKTH was finalized after the present analysis was finished. When evaluating the activity of the new institution the following facts must be considered: in the absence of a comprehensive R&D strategy numerous problems and issues have accumulated since the transition to democracy, which problems cannot be solved overnight or in a year. Having said that, the report identifies positive tendencies: e.g. steps have been made to concentrate resources, to apply the critical mass approach, to enhance the support of regional innovation and regional knowledge centres and to simplify the support-scheme system. The report should shortly be followed by a more detailed strategic analysis appraising monitoring and efficiency of R&D and innovation governance system.

4. The aforementioned measures, on their own, are far from being sufficient to increase Hungary's competitiveness at the required rate. Indeed, the R&D sector has been unable to meet the objectives of successive governments for the past fifteen years, thus the present situation is more than disturbing. The R&D sector struggles with the legacy of the transition period, which was characterized by spontaneous transformations, hasty implementation and abolishment of superficial measures and a total lack of continuity and transparency. The situation is even graver if we consider the fact that since 1990 the sector's institutional framework has constantly been changing, which unequivocally hindered the integration of R&D policy into the mainstream administration, its effective implementation and the sector's participation in the decision-making mechanisms of governments.

5. Based on the experiences and debates of the past two years, we give a detailed overview of Hungarian R&D and innovation in our report. Apart from the 'diagnosis' of the sector we also depict its international background, its main links, and based on these we present strategic ideas, which might help revealing breakout points. We did not limit our report to the appraisal of overused and restraining indicators (like R&D expenses measured against GDP and the rate of public/private R&D expenditure). Using international surveys we strive to depict a more detailed picture focusing on those aspects in which Hungary is lagging far behind. This scrutiny will reveal some catch-up paths and find the right 'therapy'.

6. The present report does not give a comprehensive picture of the complex sector as a whole. This is not the task of the Advisory Committee. We tried to analyze the situation and raise questions, which already contain parts of the answers in an embryonic form. Our aim was to generate debate in order to help develop interaction and set up paths for necessary changes.

QUESTIONS ABOUT SCIENCE AND TECHNOLOGY POLICY

7. What is the reason for the lack of a consistent science and technology policy, and that of an innovation strategy and why is there no distinct political will to have thorough analyses made? Why is the innovation absorption capacity (demand) of the business sector missing? Should there be a separate science, technology and innovation policy or should this policy form an integral part of the government's economic and national policy?

8. Is the received wisdom that Hungary is a scientific superpower still true? Is it true that the knowledge base of Hungary is still significant on the international stage? If the answers to those questions are yes, why is Hungary lagging far behind on the innovation ranking-list and is among the weakest OECD countries concerning the number of granted patents?

9. How to evaluate the institutional framework and financing system of Hungarian R&D and innovation? Is this system apt for defining research and innovation priorities, concentrating resources and, by improving innovation capacity, increasing economic competitiveness?

10. Are we able to measure Hungarian innovation capacity at all, or the R&D sector's contribution to the increase of competitiveness and to the solution of social problems, which would serve as a basis for any strategy? Are the data collection and the statistical system concerning R&D activities harmonized with the information needs necessary for developing science and technology policy? Does our statistical system meet the requirements of innovation related data collection of international organizations and the EU? Why is not Hungary using most of the instruments of R&D and innovation policies that are widely used

internationally (like technology impact assessments and foresights, monitoring and evaluation etc.)?

11. Where are the "cutting-edge industries"? Can these industries exist in a small and open economy, like Hungary's? Or should we leave the selection to the market? What are the specifically Hungarian characteristics (the so called "Hungaricum" features) in the sector and how do they appear?

12. In view of the present tendencies, will Hungary be able to meet the EU objectives by 2010 (i.e. R&D expenditure should reach 3% of the GDP, 2/3 of which to be covered by the business sector)? If the answer is no, what are the realistic goals for Hungary? What measures and structural changes would be needed for reaching the realistic goals? Has Hungary got enough professionals with the required qualification?

NATIONAL SNAPSHOT

Overview

13. According to data provided by the Hungarian Central Statistical Office, R&D expenditure between 1991 and 2003 increased from HUF 27 billion to HUF 176 billion (however the growth is only ostensive as these are not corrected values). R&D expenditure measured against GDP was constantly dropping until the mid-1990's (from 1.09% to 0.67% of the GDP), between the mid-90's and 2002 this figure grew (to 1.01%) and in 2003 it dropped back again to 0.95%. The structure of funding changed unfavourably: public funding of R&D stabilized around 55-60 % while private funding dropped from 40 % to almost 30 %, which was compensated by external, most of all EU resources.

14. Compared with other EU-members Hungary is in an unfavourable situation: the total Hungarian R&D expenditure measured against GDP is approximately half of that of the EU-15 average, while business expenditure on R&D accounts for less than one-third of that of the EU-15. In absolute value, taking the differences in GDP into consideration, the aforementioned gap is even wider, and how Hungary is to participate in the Barcelona-Lisbon process is yet unclear.

15. The institutional framework and funding system of R&D and innovation was in a state of constant and mostly unpredictable change (see chart 1 and 2), which has extremely decreased the efficiency of the system.

The "exodus" of R&D and innovation governance		*Chart 1*
Period	Institute	Head, rank and controlling authority
- June 1990	OMFB[5]	president, deputy PM, government
June 1990 - June 1994	OMFB	president, minister without portfolio, government
June 1994 - June 1998	OMFB	president, state secretary status, Minister of Industry and Commerce (June 1994 new president)
June 1998 - Dec 1999	OMFB	president, state secretary status, Minister of Economy (June 1998 new president)
Jan 2000 - Dec 2003	OM KFHÁT[6]	deputy state secretary, Ministry of Education (Summer of 2002 new deputy state secretary)
Jan 2004 -	NKTH	president, state secretary status, Minister of Education

16. Most R&D units operate in the higher education (more than 1600 units in 2003). The only positive trend in the sector seems to be the fact that the number of business R&D units has constantly been growing since 1996. The number of R&D units has almost doubled; nevertheless R&D staff number has dropped by 20% (the rate of researchers measured against the total number of active earners also decreased from 0.63% to 0.59%). The share of experimental development activity in total R&D went down (from 40% to 35%), giving rise not to applied research but to basic research in 2003.

The "exodus" of R&D and innovation financing resources	*Chart 2*
- Dec 1993	Central Technological Development Fund[7] (4.5% levy based on company profits; since Jan 1991 KMUFA resources were taken from other ministries and concentrated in OMFB)
Jan 1994 - Dec 2000	Central Technological Development Programme targeted allocation (no longer operated as a fund)
Jan 2001 - Dec 2003	Central Technological Development Programme targeted allocation and NKFP allocation as part of the Széchenyi plan
2004. jan.-	Research and Technology Innovation Fund from company levy (as a successor of KMÜFA and NKFP received all resources and obligations of those)

A Few Details

Research and Higher-Education

17. In the past fifteen years significant changes took place in R&D. These changes were characterized not by well-founded policy and strategic decisions, but by random measures. Following the transition to democracy it became obvious that Hungary's R&D institution-system and research staff was overblown compared to the country's economic development at the time and its geo-politic position. Different scenarios and models were thought up. Back then decision-makers of economic policy thought that market would make the ultimate decision as to which research and innovation activities would be needed. They decided to decrease state intervention and that the main aim of technology policy should be to stimulate companies through tried and tested instruments. But the developing new industries did not search for break-out points in research-intensive areas (a few counter-examples in pharmaceutical and the electronics industry and in agriculture did not change the general

[5] National Committee for Technological Development (Országos Műszaki Fejlesztési Bizottság)
[6] R&D Division of Ministry of Education (Oktatási Minisztérium, Kutatás-fejlesztési Helyettes Államtitkárság)
[7] KMUFA, Központi Műszaki Fejlesztési Alap

trend). Thus the biggest problem of Hungarian R&D system is not the low rate of R&D expenditure measured against GDP, but the fact that the share of business R&D expenditure in the total is less than one third of the West-European average. Furthermore, research policy priorities do not exist. The period of transition to market economy did not justify the "market" approach to R&D. Now it is apparent that an R&D policy driven solely by the market is unjustifiable not only in times of transition but also in a modern knowledge-based economy.

18. By the second half of the 1990's the research network of the Hungarian Academy of Sciences (HAS), which carries out basic research activities, was stabilized, which is a significant result, even though staff numbers were down with one third and the transformation did not follow the original plans. Considering basic research, Hungary is around the twentieth on the world-ranking list, which is a much better place than its ranking on the economic development ranking-list (if the comparative R&D expenses are considered, Hungary is among the first 5-10 countries). As in R&D in general, the main problem in this sub-sector is that the conditions for long-term planning are missing: HAS and Hungarian Scientific Research Fund (OTKA[8]) funding are often reduced either due to budget strains, irresponsibility or change in administration, this leads to dropping efficiency and under-financing. The institutes of Hungarian basic research train excellent researchers and scientists, but the distribution of excellence is uneven. Inequality in higher education – where research quality evaluation is virtually unknown – is even greater than in the institution system of HAS.

19. Inequality is a result of the new higher-education reform. The reform, following twenty-year-old West-European models, aims at radically increasing the number of higher-education students. However, Hungary's conditions are ultimately different: due to the lack of extra public funding, the expansion had to be carried out with the same number of staff using the same infrastructure. Education and research conditions at universities have strongly deteriorated, though not at the same pace everywhere. More and more "Management" programmes were set up producing more and more unemployed young graduates. Natural sciences programmes together with other so-called difficult programmes became under-represented at universities. Thus highly qualified degree-holders and skilled workers required by enterprises are equally missing.

20. The most apparent and long-term consequence of fifteen years of government influence is the virtual competition of universities for state-subsidized undergraduate places. From the point of operation R&D contribution is secondary in institutions of higher education, furthermore research and development do not play a vital role in institutional excellence. The regional knowledge and research centre function of universities hardly works, and achieving creative results is not among their priorities. Hungary lacks research universities and the criteria-system to evaluate performance, on the basis of which universities operating as national research centres could be told from institutions of education reliably disseminating basic information to masses. There is an urgent need for revitalizing staff by young professionals. Researcher and university teacher post system should be made as open as in the EU-15 and US. Inviting promising professionals with mobility experience and helping the scientific independence of the 30-40-year-old generation should be priorities. Increasing the professional and financial independence of PhD-programmes is equally important. Institutional links should be established between higher-education R&D units and the

[8] Országos Tudományos Kutatási Alapprogramok

research and development institution network. Centres of excellence working at universities should be developed as independent, functional units, exploiting the research network of HAS. Higher-education R&D should be made free of internal "bargaining" and should be put to the forefront of national R&D strategy.

21. Regional disparities in the Hungarian R&D system did not change for the better in the 90's. Regular, internationally renowned basic research activity (not as personal, but as institutional achievement) is pursued only in Budapest and a few other university-towns in the countryside. In the case of most new universities and colleges education performance is not accompanied by matching scientific results. Many of the university teachers commute from their home-institution in Budapest or other towns ("touring" professors), and they only spend the minimum time required to carry out their tasks in the receiving institution. This fact – without doubt – limits local research capacities. Significant business R&D units with international links operate solely in Budapest with only a few exceptions. There are virtually no local knowledge-intensive innovation centres with international reputation. The new technological regions in Western Pannonia and Central-Transdanubia are practically independent from local development and new technological knowledge creation capacity. While the region's new higher-education hubs, the regional knowledge centres, are only being established. So far, no significant local adaptation and diffusion capacities or spin-off company networks have been attracted to the traditional scientific centres in East-Hungary.

22. The transformation of the structure of economy and the appearance and dominance of multi-national companies has radically changed industrial R&D capabilities. The share of technology-intensive industries in Hungarian economy is high compared to our level of development. Companies operating in these industries, however, do not rely on their own local developments but mostly on the results of international networks. The Hungarian industry structure is already equivalent with that of modern economies, but its research intensity and intellectual content is not.

23. By the second half of the 90's big companies, domestic and multi-national alike, appeared which were willing and able to operate significant domestic technology capacities. There are, however, only few of them and their number increases slowly.

R&D and Innovation

24. The one-sided input approach conceals the performance of the R&D sector, and makes it difficult to judge as to what extent do R&D results contribute to the improvement of quality of life and to the enhancing of economic competitiveness. Hungarian Central Statistical Office data show that the number of R&D topics is constantly over 20,000. Thus there is less than one full-time researcher per topic. This reflects that human and financial resources are being fragmented, primarily in the public research sector.

25. In the public research network the government as the owner of the institutions plays an important role, but it is almost insignificant as a direct programme funder or innovation organizer. The state provides for the infrastructure and "survival", but it does not provide the necessary instruments for the efficient use of that infrastructure. Missing instruments include not only funding, but also an evaluation system, which would encourage excellence, as well as the continuous development of skills enabling researchers to successfully apply for other funding resources, etc. The government does not set targets and requirements, but when it does so, the results are unpredictable and not transparent. The government does not expect

anything in return, except for the efficient use of project funding (research elite on the other hand is used to talking about efficiency only if the funding was not for sure and depending on targets or results). Apart from these, the state is the funder of OTKA, NKFP (now called Ányos Jedlik Programme) and other major programmes.

26. According to statistical data, results and efficiency of the business R&D sector significantly outdoes those of the public R&D network. This is mainly due to foreign-owned firms and foreign-Hungarian joint venture companies. The capital base and risk-taking capability of domestic companies allow them to embark only on modest R&D activities. Under these circumstances profits of venture capital would be smaller than abroad. Taking the uncertainties generated by the economic policy into consideration, venture capital is considerably reserved concerning investment in innovative start-up and small companies. The main obstacle of the boom of venture-capital market in Hungary is the lack of entrepreneurial projects.

27. The rigidity of EU research funding and the fact that researchers and strategic stakeholders lose confidence in EU funding structures make participation less attractive for many researchers. Those who prove really successful use a hybrid strategy: they draw up a couple of EU-projects to prove they are internationally marketable, but the majority of their research financing comes from easily accessible domestic funds.

28. In the past few years (on the level of foreign co-ordinators) oligopolistic tendencies have strengthened in European programmes. A group of institutions and research enterprises was formed whom speak the language of eurocrats. These research enterprises are able to plan and operate joint projects in different fields, and without monopolizing a narrow field they are constantly involved in successful projects. They use almost exclusively EU financing and they operate according to the current tender-trends. Under many EU actions these enterprises, which co-operate in consortia and even restrict competition, get hold of EU project funding. As a result, the real question for Hungarian institutions is how to build the necessary trust to become part of these oligopolistic networks (first as partners, later as leaders).

29. There is a split in the research labour market putting researchers working as civil servants into an overprotected position. The present legal framework protects civil servants to an extent, which even hinders development, and ties the hands of research management, who are unable to react to drops in performance and to withholding results. For the rest of the researchers it is difficult to plan their careers. While non-civil servant team-members (PhD students and researchers employed under the projects) are the ones who carry out an increasing number of project tasks, they remain unprotected.

4. STRATEGIC REMARKS ON THE NATIONAL INNOVATION SYSTEM

International comparison

30. Significant efforts have been made in recent years to measure a country's innovation capacities. Since the millennium, the EU annually publishes the European Innovation Scoreboard, EIS, to compare data regarding the performance of Member States and applicant countries. Among others, indicators include public and business R&D expenditure (percentage of GDP), rate of R&D workforce, number of patents, expenditure in education measured against GDP, rate of science and engineering graduates among all graduates, number of PhD holders, participation in lifelong learning within the total workforce, rate of

employed persons in the medium and high-tech manufacturing and in the high-tech service sectors, vocational training expenditure, number of Internet users within the whole population, ICT expenditures measured against GDP, etc. Methods applied to measure innovation performance serve as a single framework for data collection and analysis, thus making it possible to compare the performance of different countries and to reveal the underlying causes. However, it should also be mentioned that the methods to collect domestic R&D statistical data are far from being satisfactory at present, and unfortunately there is also a lack of strategic analyses, which often require versatile research work.

31. According to surveys based on the Summary Innovation Index (SII) published by EIS, Hungary saw its place low on the ranking list in 2004, well below the EU-15 average. Hungary's result was 0.25 (the SII scale ranges between 0 and 1), the EU-15 average was 0.44, while for instance Finland scored 0.75, Germany 0.56, France 0.46 (the SII performance of the US was 0.70, steadily higher than that of the EU-15, while Japan scored 0.77.)

32. When analysing the US's advantage over the EU, it seems – according to several analysts – that this success is partly due to the pivotal role of non-technical innovation. The reform of various company management techniques is faster and the society is more inclined to accept changes in the US. In Central-Europe, thus in Hungary as well, the situation is controversial.

33. Compared to the EU-25, demand for R&D is the lowest in the Central and East European (CEE) countries, the situation is quite homogeneous in these countries in this respect. Primarily, the better absorption capacity and the stronger R&D supply are the advantage of the 'developed' CEE countries – like Hungary. There is relatively good chance to achieve cohesion. In fact, the four developed CEE countries (Slovenia, Estonia, Czech Republic and Hungary) are closer to the EU average than to the cohesion countries. The solution is the balanced improvement of demand and supply. This also means that public expenditure is not enough on its own without increasing the demand of the business sector. This should be followed by diffusion, while Hungary's strength lies with its absorption capacity.

Strategic considerations

34. Detailed analysis of the relatively strong R&D supply highlights the serious weaknesses of Hungary (see Table 1 showing the EU-15 average and the data of four other EU countries where public R&D expenditure is similar to that of Hungary). While according to the appraisal of EIS, Hungary is situated in the middle of the ranking list regarding its public R&D expenditure, but on the basis of the so-called BERD/GDP indicator (business expenditures) Hungary is ranked lower and the gap compared to the EU15 – disregarding Portugal – is apparently huge. Hungary does not reach the one-third of the EU-15. The situation is striking with regards to patents (Table 1), and trends are unfavourable, too. The number of patents applied and granted per researcher was cut almost by two-thirds between 1990 and 2002. In 2002, there were 3.1 patent applications and 2.1 granted patents per hundred researchers in full-time equivalents (FTE). According to the OECD ranking list of 26 countries that shows the number of patents per thousand populations, Hungary belongs to the last group. The business sector has 70 % of patents. The rate of patents owned by foreigners is also around 70%, thus Hungary's performance seems rather weak. These data clearly indicate diffusion problems: where is the exploitable innovation in the research sector and why are not the excellent achievements of basic research – which are measured by publication output – exploited? The relative lag of Central and Eastern Europe is only partly

due to insufficient R&D activities, it is rather the consequence of underdeveloped patenting activity and the comparatively low rate of employed degree holders.

Country/ Region	Public R&D/GDP (%)	Business R&D/GDP (%)	Patent applications *	Zero innovation** (%)
Hungary	0.57	0.38	21	75
EU-15	0.68	1.30	161	55
Austria	0.65	1.13	180	50
Belgium	0.57	1.60	152	50
Italy	0.55	0.56	81	65
Portugal	0.58	0.27	7	55

Table 1. Innovation indicators of Hungary and some EU countries (2003)

* Number of patents applied for at the European Patent Office per million population.

** Rate of firms in the manufacturing and service sectors that do not innovate according to EIS (2004) (EU-15 data is estimate).

35. Poor domestic demand for innovation can primarily be explained by the structure of enterprises. For instance, there are 670 R&D units per 142,000 enterprises with legal entity which is a very low figure. This, however, just seems to be surprising as according to statistics 63% of enterprises have less than 1 employee on average and only 0.1% of them employ more than 250 people. 90% of the enterprises in the manufacturing sector have less than 10 employees and regional discrepancies are huge, with Pest county, North-West Hungary and Transdanubia in the lead. The business sector is still weak and there are just a few medium-sized enterprises with huge capital base. As a consequence, demand for innovation is poor. According to the survey of EIS (2004), 75% of firms in the manufacturing and service sectors do not innovate in Hungary (Table 1) and thus, Hungary is among the worst performers, just like in the case of patents.

36. According to the EIS survey, Hungary does not have a bad ranking position concerning its (knowledge) absorption capacity – at least not in the CEE region –, moreover, this capacity is even better than Hungary's R&D performance. The more we go into details, the graver the situation seems. The rate of science and engineering graduates in the 20-29 years' age class does not reach half of the EU-15 average, and Hungary is the only one showing a decreasing tendency in this respect among the countries in Table 1. The rate of participation in lifelong learning is similarly low.

37. The rate of employed persons in the medium and high-tech manufacturing sectors only seems high – as high as in Finland and Sweden – but BERD/GDP in Hungary is paradoxically only one-eighth of that of Finland and Sweden, which indicates low efficiency. This phenomenon shows that while the Hungarian economy is relatively up-to-date regarding its industry and export structure, R&D efforts do not reflect these proportions at all. The rate of Hungarian ICT (information and communication technologies) production in value compared to the manufacturing industry exceeded the indicators of Canada and the United Kingdom, but internationally recognised innovation of the sector seems to be negligible.

38. Moreover, the restructuring of R&D shows several unfavourable signs – as it has already been partially referred to. Thus, for example, the number of R&D units of higher education and of enterprises increased between 1990 and 2002, but at the same time, the number of employed persons in R&D and the working time spent on R&D activity dropped. The average number of personnel has been reduced to one-third per workplace (29 → 10), while only 18%

of the total R&D staff work in the business sector. The number of researchers per inhabitant is hardly more than half of the Austrian and one-fifth of the Finnish values. What's more, the values are even more disproportionate in the business sector. According to the mobility survey of the HAS-Institute of Sociology, the number of fluctuations per researcher in science and engineering R&D units in the past five years was 0.11. This rigid labour market is one of the obstacles of the professional and intellectual renewal of R&D.

39. According to analyses, the main issue of Hungarian innovation policy is not that Hungary does not have exploitable R&D capacities or that new institutions are needed to be set up now, but that the existing network is of mixed efficiency and the performance of some of its units is even deteriorating. Thus, demand and diffusion should be basically strengthened. Significant prerequisites include elaborating and implementing integrated R&D, education, science and economic policies, as well as introducing new products, innovative services and up-to-date technologies. The increase of public expenditures on its own leads to a dead-end. It is essential to strengthen the domestic business sector and to increase its risk-taking capability.

THE WAY FORWARD

40. What should be done? Political and social recognition, consensus is needed which is able to integrate innovation – complying with the requirements of a knowledge-based society – into the process of modernisation as the main driving force of long-term development of economy and society. Professionally well-founded science and technology policy, and a coherent strategy, reaching over several terms of administration and accepted by political parties are necessary, as well as their consistent implementation. There is no need for fragmented programmes, which rarely strengthen each other’s impact. This is the main "message" of this document.

41. The total R&D expenditure in Hungary was 0.95% of the GDP in 2004. The share of the business R&D expenditure of the GDP was extremely low, only 0.38%. The realistic target in the next 5 years seems to be the increase of R&D expenditure (measured against GDP) by 0.10 - 0.15 percentage points annually, at least 2/3 of which should come from the business sector. This would only be the first step in catching up with the EU-15 average (1.98% and 1.3%), which itself is lagging far behind the Lisbon target (R&D expenditure: 3% of GDP, 2/3 of which should be funded by the business sector).

42. Education, science and technology policies should be synchronised in order to represent innovation interests. The "win-win" cooperation of key stakeholders (research institutions and units, universities, spin-off companies, small and medium-sized enterprises, etc.) having common interests should be ensured by smart programmes, incentives and adequate financing mechanisms, as opposed to the present practice of segregation and unwanted clashes. Short-term tasks, which have favourable impact on innovation activity, should be examined on governmental level and on the basis of these, strategic goals should be set up. The first step of the "therapy" should be the well-considered creation of government regulations to ensure the implementation of the act on innovation (see Government Decree Nr. 2286/2004. (XI.17).

43. The basic issue of the Hungarian innovation policy is the strengthening of the weak supply and diffusion (knowledge flow). It is obvious that the increase of public expenditures on its own leads to a "dead-end". It is essential to strengthen the domestic business sector and to increase its risk-taking capability.

44. Domestic small and medium-sized enterprises (SMEs) should receive a favourable treatment. Elaboration of a government strategy aiming at the development of innovative SMEs is one of the most urgent tasks. Public funding should not only serve as capital substitute, but also as a stimulating factor for innovation activity forming an integral part of the tax and monetary policies. The Hungarian economic growth cannot be exclusively based on the change of investment attitude of international enterprises in the long run.

45. Technological innovations can only be successful if enterprises introduce all the necessary structural, management and market, etc. innovations. The creation and development of regional networks strengthening diffusion as well as incubation systems hosting innovative enterprises in knowledge centres should be promoted by public instruments. This is the prerequisite of the exploitation of targeted basic research as an integral part of the innovation chain.

46. Restrictive legislation preventing pension funds and insurance companies from investing in venture capital funds should be revised. Risks could be decreased by combining public and private capital. Support mechanisms with public financial commitment should be introduced to make projects more attractive for private capital.

47. Responsible modernisation policy is needed, which is committed to innovation and sets up and operates an institutional system, which can help governmental decision-making and delivery with adequate "reflection" capabilities. The analyses needed (technology impact assessment, collection and analyses of R&D and innovation statistics, technology foresight, systemizing of institution- and programme assessment) could ensure correct political decisions.

48. Fundamental financing and legal obstacles should be demolished and predictability should be guaranteed. Public financing of R&D should not be the residual element of budget-policy.

49. The huge number of on-going programmes with public financing should be screened and evaluated urgently, and only those should be continued which are the most efficient on the one hand, and those which best comply with the innovation policy objectives defined on the basis of the present analysis. The tender system should be transparent, red- ape must be cut, and monitoring tasks should be performed by independent bodies. Priorities must be set, topics should be concentrated and fragmentation of human and financial resources must be avoided. The number of researchers per topic should be raised (from less than 1 person / topic) to over the critical level necessary for efficient operation.

50. Success in innovation should receive bigger publicity; public awareness should be raised concerning the importance of R&D in the improvement of quality of life.

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