Does innovation policy matter? The case of Hungary

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Introduction

Having completed the first phase of its transition, Hungary has again reached a crossroads. While the one-party system has been replaced by a multi-party parliamentary democracy and the planned economy with a market economy based on private ownership, the world has significantly changed during this historically short period of time. Practically all of Hungary's intellectual and material resources have been used to accomplish the fundamental social and economic transformation process as quickly as possible, so the focus has been on "burning" issues like budgetary pressures, current account and trade imbalances, foreign debts, inflation, privatisation. A number of new political and economic institutions required for long-term development have also been (re-)introduced. Yet, most efforts have gone towards solving short-term problems and thus it has hardly been possible to pay sufficient attention to the emerging global trends, nor to devise an appropriate strategy to improve Hungary's long-term competitiveness in these new settings.

Thanks to significantly improved economic performance and given the main European and global developments (*e.g.* enlargement of the European Union — EU — envisioned by 2004, structural changes in a number of industries), a longer-term approach is now needed. Hungary has to consider what role to play in the globalising learning economy, *i.e.* what future it envisions for itself. To be more specific, does the country passively accept the fate of a mere surviving economy, drifting along without having its own strategy? Or, by implementing a clear strategy, does Hungary intend to be a prosperous country in which most citizens enjoy high living standards, good health and a clean environment within 15-20 years?

A sound, coherent innovation policy is one of the cornerstones of an overall development strategy that is required if a country is to excel. Without the co-ordinating framework that a consistent, broad innovation policy can offer, it is not possible to use resources in the most efficient way. Yet in spite of a number of attempts in the 1990s no such policy document was approved in Hungary.

This article follows an evolutionary economics of innovation framework.[1] One of the most important policy implications of this school is that public policies should be aimed at promoting learning in its widest possible sense, in other words competence-building at individual, organisational and inter-organisational lev-

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els. Co-operation and networking among a host of actors, including not only researchers and producers but also users is a vital element in generating and disseminating knowledge.[2] A system-approach is required, therefore, in policy-making, whereby 'policies recognise the division of labour in the generation of innovation-relevant knowledge, that no individual firm is self-sufficient in its knowledge and skills and that there are corresponding gains from linking firms with the wider matrix of knowledge-generating institutions' (Metcalfe and Georghiou 1998:84). Indeed, a recent trend in the science and technology (S&T) policies of advanced countries sees a shift from direct research and development (R&D) support to promoting linkages, communication and co-operation among the players in the innovation process and thus building an appropriate organisational and institutional infrastructure.[3]

Other policies, such as investment, privatisation, industrial, regional development, competition, trade, monetary, fiscal, education, labour market and foreign policies, also have certain bearings on innovation and diffusion and should thus be coordinated as well.

One of the underlying postulates of evolutionary economics is that "history does matter". Indeed, the legacy of planning, and especially of the reformed economy, still has non-negligible impacts on the political and consumer "tastes" of people, workers' norms, managers' behaviour, as well as policy-makers' thoughts (*e.g.* because of the old dilemma of growth *vs.* stability, the burden of foreign debts since the late 1970s). These experiences, expectations, attitudes and behavioural norms — together with the inherited economic problems, of course — constitute a relatively controversial legacy for the transition process. Hence, they are directly or indirectly important factors for the innovation process, too. Space limits do not allow to discuss them here in detail, but some of these factors are used at various points of this article as explanatory variables.[4]

The article first provides a brief overview of the transition process in Hungary, emphasising the simultaneous need for systemic (institutional) changes and macroeconomic stabilisation in order to improve (micro-)economic performance. Its core section analyses recent changes in the S&T decision-making system, various efforts to draft S&T and innovation policy documents, as well as the inputs and outputs of R&D and innovation. It concludes that given the strong need for aligned public and private efforts, the present "implicit" innovation policy in Hungary cannot provide appropriate answers to the current challenges.

Transition Process: Systemic Changes and Stabilisation

Given the planned economy heritage, it was not only the "usual" macroeconomic stabilisation that was required in Hungary at the beginning of the 1990s but a much more challenging, more complex modernisation programme introducing fundamental structural, institutional changes. In other words, systemic changes were required in order to make Hungary a viable economy. This difficult enough task was further exacerbated by an additional socio-psychological factor. Most Hungarian citizens (like in other transition countries) associated the economic and socio-psychological hardship of the 1990s with the new socio-economic (political) system, although the harsh austerity measures were in fact necessitated by the legacy of the former system.[5] Policy-makers and politicians, therefore, were reluctant to devise and implement a "textbook-case" stabilisation programme. They were inclined to "soften" macroeconomic policies as soon it seemed possible, usually earlier than was really feasible and reasonable from a strict economic point of view. The concomitant "oscillation" in macroeconomic indicators can easily be detected in Table 1.[6]

Legal and Institutional Framework

The first phase of the transition process in Hungary is now over. The most important political and economic institutions have been re-established, including a parliamentary democracy based on a multiparty system, the private ownership of assets, free factor and commodity markets and a stock exchange.[7] Some crucial economic institutions — *e.g.* a two-tier banking system, a "Western-type" taxation system (value-added tax, personal income tax) — were introduced as early as 1987, that is, preceding the systemic changes. Most firms and banks were privatised by the mid-1990s, mainly by foreign investors, *i.e.* by genuine owners (as opposed to "artificial" ones created by various voucher schemes in other transition countries).

In 1990, the proportion of state ownership was over 90 percent in the Hungarian economy. By 2000 this had reached almost the opposite end of the scale with private ownership representing almost 80 percent. A similar change took place in the structure of gross domestic product (GDP): the private sector's contribution to GDP was some 25 percent in 1990, increasing to 90 percent by 2000 (TEP 2001:28).

The institutional structure of economic policy-making and its implementation have been significantly re-organised. The independence of the Hungarian National Bank is guaranteed by law. The state budget has been reorganised into independent sub-systems and its deficit is being funded by the capital market. The financial sector has been restructured. Competition has emerged in the commercial banking and insurance sectors, and a large number of consulting and brokerage firms have been established. The Competition Office is now in operation and extensive reforms have been introduced in the social security system.

A number of important tasks remain, however, including the achievement of legal harmonisation with the EU and the completion of state budget reforms.

Macroeconomic Performance and Microeconomic Adjustment

Hungary has inherited a non-viable economic system. Most companies became complacent in the period of the planned economy: they became accustomed to enjoying a quasi-monopoly in the domestic market and a huge "hungry" and therefore not overly demanding export market in the CMEA,[8] mainly the former Soviet Union. They could also count on regular bailouts, whenever it was necessary. The size distribution of firms was distorted (lack of small and medium enterprises — SMEs, the dominance of inflexible, large firms, which however lacked economies of scale as they had been created artificially by merging medium-sized firms located in different parts of the country). Foreign trade was mainly conducted with other CMEA-members. To keep this sinking boat afloat, *i.e.* to prevent an open economic and political crisis, excessive foreign debts had accumulated by the late 1980s. With the collapse of CMEA, practically all large firms lost their markets overnight, with their domestic suppliers, in turn, also collapsing. That was the "recipe" for the most severe economic crisis in the history of Hungary; its consequences were at least as serious as the impacts of the Great Depression in 1929-33. In the first three years of the transition process more than 1.5 million jobs were lost, and the GDP dropped by almost 20 percent (Antal 1998a:57).

After that sharp decline in the early 1990s the Hungarian economy has been "bouncing back": falling inflation and unemployment rates together with accelerating GDP growth have characterised the last four to five years (see Table 1). GDP reached the "pre-transition" level, that is, the level for 1989, by 1999. Economic growth is almost twice the rate seen in the EU (2.5 percent and 3.4 percent for the EU15 in 1999 and 2000, respectively). The stock of foreign direct investment (FDI) *per capita* is the highest of CEEs, although since 2000 it has been "neck-and-neck" with the Czech Republic (over USD 2000 *per capita,* author's calculation based on UN ECE 2001:177).

The strict macroeconomic management regime since 1995-96 has undeniably contributed to the country's successful macroeconomic performance. A major positive trend has been the strong export-orientation of the industrial sector, largely due to the fact that quite a few Hungarian firms — especially those in automotive and electronics components, as well as in telecom equipment manufacturing sectors — have been re-integrated into international production networks either as subsidiaries or independent suppliers to multinational corporations (MNCs) (Havas 2000b; 2001).

Yet there is still a considerable gap between two groups of manufacturing firms. On one hand, large, mostly export-driven, efficient and profitable foreign-owned firms, operating high-tech equipment account for the impressive micro-economic statistics. Most of their local suppliers — either foreign-owned or domestic — are also successful and have promising prospects. On the other hand, a large number of indigenous, mostly SMEs can be found, usually lacking the

Table 1: Main Economic Indicators, 1990-2000 (Previous Year = 100)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
GDP	96.5	88.1	96.9	99.4	102.9	101.5	101.3	104.6	104.9	104.2	105.2[b]
Exports	95.9	95.1	102.1	89.9	113.7	113.4	107.4	129.9	122.5	115.9	121.7
Imports	94.8	105.5	100.2	120.2	108.8	99.3	105.7	126.4	124.9	114.3	120.8
Consumer price index	128.9	135.0	123.0	122.5	118.8	128.2	123.6	118.3	114.3	110.0	109.8
Trade balance (USD billion)	0.9	-1.2	-0.4	-3.6	-3.9	-2.6	-2.4	-2.1	-2.7	-3.0	-4.0
Current account balance (EUR billion)	0.1	0.2	0.2	-3.0	-3.3	-1.9	-1.3	-0.8	-2.0	-1.9	-1.4
Foreign direct investment[a] (EUR billion)	..	1.2	1.1	2.0	1.0	3.5	1.4	1.6	1.3	1.5	1.5
International reserves (year-end, EUR billion)	..	3.0	3.6	6.0	5.5	9.4	7.8	7.6	8.0	10.9	12.1
Registered unemployed (year-end, thousands)	80	406	660	632	520	496	478	464	404	405	372
Budget balance/GDP (percent) (excluding privatisation proceeds)	0.3	-2.9	-7.0	-5.6	-8.4	-6.8	-3.1	-4.6	-6.3	-3.7	-3.4
Net foreign debt (including loans provided by parent firms for subsidiaries, EUR billion)	11.8	10.9	10.8	13.4	15.4	12.7	11.7	10.7	11.0	11.2	12.2

Notes to Table 1: a Equity capital; b Preliminary data;

Sources: compiled from annual reports of the Central Statistical Office, Ministry of Finance and National Bank of Hungary.

capital for development, applying obsolete technologies and thus facing the threat of bankruptcy or stagnation with an ongoing, tough struggle for survival — at best a relatively risky future with low growth potential (TEP 2001).

S&T and Innovation

Reflecting the recent policy approaches in evolutionary economics of innovation, Dodgson and Bessant (1996:4) proposed a clear distinction between science, technology and innovation policy. They define science policy as 'concerned with the development of science and the training of scientists,' while technology policy 'has as its aims the support, enhancement and development of technology, often with a military and environmental protection focus'. Innovation policy, however, takes into account the complexities of the innovation process, and hence aims to facilitate interactions between firms of all sizes and public and private research institutes (1996:4-5). These definitions are applied in the remaining sections of the article.

A number of important legal and organisational changes have occurred in the S&T system since the early 1990s, especially concerning intellectual property rights, higher education, as well as the Hungarian Academy of Sciences.[9] As space limits prevent even a short description of these changes, this section only discusses the reorganisation of S&T policy-making bodies, the main policy documents devised in the last decade and their implementation. Finally, it highlights an apparent paradox between the severely cut R&D resources and the relatively successful innovation performance.

Reorganised S&T Government Bodies

The main S&T government bodies were constantly reorganised throughout the 1990s, but pointing in the same direction. They strongly suggest that innovation has not been on the top of the agenda of any government since 1990. While the OMFB (Országos Műszaki fejlesztési Bizottság — National Committee for Technological Development) used to be headed by a deputy prime minister until 1990, but since then it has constantly been "demoted" in this respect: in 1990-94 its President was a minister without portfolio, in 1994-99 a secretary of state "supervised" by another minister, and from January 2000 a deputy secretary of state, as the OMFB itself was "relegated" from being a government agency to a division of the Ministry of Education.

The most worrying consequence of this latest reorganisation is a key change in the decision-making system. Until the end of 1999, strategic issues were decided on by the OMFB Council. It was a 15-strong committee appointed by the Prime Minister consisting of high-ranking representatives of six interested ministries and the research community, as well as business people and an innovation policy expert. Given the nature of the innovation process and the concomitant need to co-ordinate the resources of various ministries as well private efforts, this seemed to be a reasonable organisational framework for making strategic decisions. Since January 2000, however, the former OMFB Council is no longer a decision-making body; it is an advisory board for the Minister of Education.[10]

The highest-ranking committee responsible for science or S&T policy — known under various names, more recently as S&T Policy Council — has shared a somewhat similar fate; its political status has also been constantly eroded since 1990

(Havas 2001). The failed attempts to obtain government approval for technology and innovation policy documents, discussed in the next subsection, as well as the downward trend in government funding of R&D (see Table 5) can only reinforce the above observation.

S&T and Innovation Policy Documents

Transition has brought about a number of crucial political and economic changes affecting the S&T system. A number of S&T policy documents have also been drafted. However, up until 2000 no systematic technology or innovation policies had been "rubber-stamped" — let alone carried out — by the government.

In 1995, OMFB drafted a policy document entitled "The Government's Concept for Technical Development", providing a vision and listing government tasks in both the short and long run. The OMFB Council discussed it and gave its full support. This document even summarised the most common arguments levied against a more pro-active S&T policy, together with counter-arguments, in an attempt to convince politicians and government officials that the Organisation for Economic Co-operation and Development (OECD) and EU member-countries are not following an extreme "*laissez-faire*" ideology. Further inter-ministerial discussions were blocked by the Prime Minister's Office, and hence the document never reached the cabinet.

In 1996, a "Modernisation Programme" of the then government coalition was formulated, "recycling" some elements and ideas from the aforementioned document (OMFB 1995), but again there was no political will and support for an innovation policy. Given the drastic stabilisation programme launched in 1995 there were no extra funds available to promote R&D and innovation. In fact, finance for R&D reached its lowest level ever in these two years (1995-96). Apparently, policy-makers can only think of a new policy when they have additional resources. Most likely, it would be too difficult for them to reallocate the same — or shrinking — funds for new priorities as it would hurt a number of groups with a strong bargaining position.

Yet another policy document has been drafted by OMFB staff by November 1999, entitled "Innovation Strategy for Competitiveness" (OMFB 1999). Before any attempt to implement this strategy, the OMFB was merged with the Ministry of Education, as already discussed. The new political leaders who took control of R&D and innovation policy have simply not considered that document at all.[11] It was printed in December 1999, but its circulation was stopped in early January 2000.

The government's latest R&D policy is set out in a document entitled "Science and Technology Policy — 2000" (OM 2000). This document was first approved by the Science and Technology Policy Council in March 2000, and then confirmed by a government decree in August 2000. Despite its title, it is mainly a science policy document identifying five "national R&D programmes" on:

— improving the quality of life (*i.e.* biomedical, pharmaceutical and related projects);
— information and communication technologies;
— environmental and materials research;
— agribusiness and biotechnology; and
— national heritage and contemporary social challenges.

There are two key shortcomings of this document. First, it would be hard to find any experienced researcher who could not "package" his or her project under the label of one of these five "national programmes". Second, it can be seen as a sharp return to the "good old" linear model of innovation, indicating the strength — as well as the way of thinking — of the "science" lobby. The systemic, complex nature of innovation, even the basic concept of demand for innovation, is not considered at all.

Research, development and innovation is one of the seven programmes outlined in a recent national development strategy, the Széchenyi Plan, also launched in 2000 (GM 2000). Its chapter 4, entitled "Program for the Support of Research, Development and Innovation Programme", consists of three sub-programmes for:

— the five national R&D programmes mentioned above;

— 'the extension of existing R&D support schemes and promotion of the R&D institutional network'; and

— 'increasing the absorption capacity of the R&D institutional network'.

As it is not easy to understand even the Hungarian titles of the latter two sub-programmes,[12] their official translation is used here.[13] Their relatively short explanation — in either case just a few lines — suggests that the main aims are to strengthen the R&D institutes' capabilities as a pre-requisite to conducting the "national R&D programmes" and increasing the number of R&D personnel in both the public and private sectors. Again, an overriding emphasis is put on the "supply" side, while quite a few important players and elements of the innovation process are eclipsed.

Participants in the first Hungarian Technology Foresight Programme (TEP — Technológiai Előretekintési Program), launched in 1997, however, took a broader analytical framework.[14] Their main concern was to identify major tools to improve the quality of life and enhance international competitiveness, and thus they emphasised the significance of both knowledge generation and exploitation and the diffusion of knowledge. It is clearly reflected in all types of TEP results (Delphi-survey, long-term visions and policy recommendations), which will now be briefly discussed in turn.

Statements for a two-round Delphi-survey[15] were formulated by some 200 panel members of TEP. If anything, the almost exclusively science and technology-oriented Japanese and British questionnaires could have possibly affected the panel members when formulating their statements for the Hungarian Delphi-survey. Furthermore, most of the panel members were not policy analysts or social scientists, but research scientists and engineers or managers. Yet, the number of statements dealing with non-technological issues exceeded that of S&T ones (177 and 172, respectively).[16] Furthermore, half of the "top 10" Delphi-statements — those deemed most favourable by the respondents, *i.e.* with the highest combined socio-economic and S&T impacts — were non-technological in their nature. This result indicates the importance of human resources, regulation and institutions, that is, the salient relevance of an innovation system approach in a transition country. The majority of respondents — mostly technical experts (Havas 2000a), and not social scientists attracted to some "fluffy" theories on the importance of networks, co-operation and institutions *etc*. — put as much weight on these non-technological issues than on the technological ones.

Long-term visions and policy recommendations of the seven panels also turned out to be formulated in the broader context of innovation. It is also telling that the Steering Group (SG) grouped its 22 recommendations under three main headings:

— an educated, co-operative, flexible and healthy population, adaptable to the ever-changing surroundings, ideas, solutions and value systems;

— a clean and healthy environment; and

— an appropriate, strong and effective national system of innovation.

Yet, these recommendations, albeit broadly shared by the contributors to the foresight process — either as panel and SG members, respondents to the Delphi-survey or participants at more than a hundred workshops — did not have any significant effect on the policy framework before May 2002.[17]

To sum up, a coherent policy framework for innovation is yet to be developed in Hungary. To achieve this, it might be useful to explore why all these attempts have failed so far. One might argue that the lack of adequate funds, at least until 1996-1997, has not permitted to devise and implement "costly" policies. Indeed, most long-term policies, such as education, infrastructure, innovation, industrial, SMEs, regional, health care, and environmental ones, would require substantial investment projects and/or generous subsidies. The transition process, however, has hit Central European countries hard: they have to cope with significant budget deficits plus find the means to tackle more urgent needs such as rocketing unemployment.[18] However, money is always a scarce resource and when a country is in a particularly difficult situation there are even more pressing reasons to devise and implement a sound strategy (be it innovation or any other strategy). If policy-makers only focus on "crisis management", neglecting the fundamental, structural factors, then the "roots" of the problems remain intact, causing more difficulties in the near future, and hence necessitating yet more "crisis management". In the worst case, even vicious circles may develop, draining all the material and intellectual resources, *i.e.* never allowing the finding of a long-term solution.

From a broader perspective, one might identify further, somewhat "softer", yet more convincing reasons. The former socio-economic system — especially the poor economic performance in spite of the plethora of so-called central development programmes in the 1970-80s — discredited government-led efforts in general, almost regardless of the substance and quality of such strategies.[19] More "abstract" ideological stands against an apparently increased role of government were also at work to abort any overarching innovation strategy, especially in the early 1990s. Moreover, there have been vested interests against concerted efforts in Hungary, too, just as in many other countries: government departments and agencies usually prefer not to share their resources with each other even if their co-operation could lead to more efficient public spending.

Further, in the first ten years of transition there were strong illusions and misconceptions concerning R&D and innovation activities and policies. One of these was that scientific knowledge would automatically become technological capability; hence, no specifically designed schemes would be needed to facilitate this process. Also, in the first half of the 1990s policy-makers apparently did not realise the link between economic development and S&T efforts. It may not have been a deliberate policy. Yet, their (non-)actions imply that they assumed that R&D expenditures can be cut without serious socio-economic consequences. The irony is that this view was not without its foundations in the specific Hungarian circumstances for two reasons. First, given the poor economic performance during the planned economy period, the return on R&D expenditures was a largely neglected issue on the whole. Second, new technologies brought in by foreign investors "in bulk" since the early 1990s indeed facilitated rapid industrial re-structuring and market re-orientation without much local R&D input.[20]

There is a big policy problem with this view, however. Economic development can indeed be maintained, or even accelerated, without indigenous R&D and innovation efforts in the short run thanks to FDI. Yet, a country opting for this "development" path becomes not only overly dependent on foreign technologies but would most likely also lose its attractiveness: at best becoming the "dumping site" of outdated technologies, or even abandoned by foreign manufacturing firms altogether. From a different angle, this way of thinking clearly cuts innovation from R&D, considering the latter one to be a luxury, or a privilege for a narrow elite, ignoring the abundant evidence accumulated by the economics of innovation and all the policy implications (Ergas 1987; Levin *et al*. 1987; OECD 1992; 1997; 1998; 1999; 2000; 2001a; Nelson 1993; EC 1996; Freeman and Soete 1997; Lundvall and Borrás 1999).

Implementation

As for science policy, it has been implemented through the annual government grant to the Hungarian Academy of Sciences (HAS) and its subsequent allocation among the HAS institutes and the Hungarian Scientific Research Fund (OTKA — Országos Tudományos Kutatási Alapprogramok).[21] Hungarian scientists can also apply for government-funded grants to finance their research activities in Hungary for a four-year period[22] or abroad (usually for a few months). Funding through the new "national R&D programmes" started in 2001, and is administered by a newly established Programme Office. The Higher Education Development Programmes (FEFA — Felsőoktatási Fejlesztési Alapprogramok) can also be regarded as an indirect science policy tool.[23]

Technology policy schemes, on the other hand, used to be devised and administered by the OMFB until 1999. Schemes were revised annually, and approved by the OMFB Council, as were the funds earmarked for them. Since January 2000, when the OMFB was taken over by the Ministry of Education, the Minister has taken these decisions.

Firms, universities and other R&D units can apply for favourable loans or grants under these schemes. Some are aimed at supporting certain technologies, while others can be regarded as innovation policy tools (following the definition of Dodgson and Bessant 1996). The former ones are listed below (as of 2000-2001):[24]

— information and communication technologies;
— biotechnology; and
— environmental technologies.

Some schemes have been specifically designed with a systemic approach in mind, *i.e.* to facilitate network building, communication and co-operation among various players of the national innovation system. Hence, these can be regarded as implicit innovation policy tools. Their main characteristics are described below.[25]

The Co-operative Research Centre (CRC) scheme was launched in 1999 to foster strategic, long-term co-operation between higher education institutions, other non-profit R&D units and businesses, by establishing CRCs. The overall goal, on one hand, is to promote innovation and competitiveness and, on the other, to "inject" practical, business considerations into research carried out at higher education institutes, and indirectly to also enrich the curricula with these aspects. It is needless to stress that both are crucial in Hungary.

The "Integrator" programme is another important "innovation-minded" scheme, designed to support inter-firm co-operation. This scheme was initiated by large companies in early 1999, and launched already in the same year. Its main aim is to improve Hungarian SMEs' innovative capabilities and competitiveness, promote their networking activities to conduct technological development projects and, as a result, to help them becoming suppliers of large firms. Large firms and their potential suppliers can only apply jointly, as a consortium.

Yet another set of schemes is aimed at developing the physical and institutional infrastructure of R&D and innovation, and hence it would hardly be possible to classify them as "pure" technology or innovation policy tools. In other words, their likely impact is twofold: enhanced development of certain technologies (products, processes) but in the meantime more intense and deeper interactions among the players of national and international innovation systems, as their objectives, summarised in Table 2, reveal.

R&D and Innovation Performance: An Apparent Paradox

Available data suggest an apparent paradox between the declining R&D activities (more specifically R&D inputs) and the strong, successful innovation performance. A closer look, however, reveals that it is a somewhat deceiving paradox as the strong innovation performance is mainly due to FDI, other forms of technology acquisition, as well as local innovative but not formal R&D activities.

R&D expenditures have dropped significantly since the late 1980s. Whereas 2.3 percent of GDP had been devoted to R&D in 1988, this ratio fell to 0.7 percent by 1996 and has remained at that level until 1999.[26] Given that GDP only reached its 1989 level in 1999, it is indeed a dramatic drop (see Table 3). To compare, EU countries on average spend around 1.8-2 percent of their GDP on R&D.[27] This is already a huge difference, moreover, their GDP *per capita* is three times higher than the figure for Hungary.

In 2000 the Hungarian government declared that gross domestic expenditure on research and experimental development (GERD) should reach 1.5 percent of GDP by 2002. A number of experts had doubts, however, about the feasibility of this goal. Their two main reservations were whether this pledge would be fulfilled at all, and if yes, whether R&D expenditures could be possibly doubled in an efficient way within the space of two years. Preliminary data justify this scepticism: GERD remained well below the target, reaching only 0.94 percent of GDP in 2001.

Table 2: Further Schemes Funded by the Central Technological Development Fund (1999-2001)

Scheme	Objectives of scheme
Applied R&D Programme	Fostering the development of new products, services and processes
Competitive Product Programme	Improving the competitiveness of existing products by R&D
"Maecenas" Programme	Supporting participation at, or organisation of, conferences, paying membership fees in international S&T organisations
Regional Innovation Programme	Promoting R&D by SMEs through projects devised by county Chambers of Commerce or their consortia
Special Innovation Programme for three counties	Improving the innovation skills of SMEs in "cohesion" areas
TECH-START Programme	Promoting the growth of innovative SMEs
Liaison Office Programme	Assisting Hungarian participation in the EU 5th RTD FP
Consortium Building Programme	Assisting Hungarian participation in the EU 5th RTD FP
Participation in the NATO (North Atlantic Treaty Organization) Science Programme	Fostering international S&T co-operation
Private Investment in Applied R&D	Fostering private investment in R&D (extending existing R&D units or establishing new ones, and thereby creating new R&D jobs in the business sector)

Source: author's compilation from OMFB documents launching the various technology policy schemes.

Inevitably, R&D personnel were also cut drastically up until 1995, by 56.5 percent compared to 1988.[28] Since then, a slight increase can be observed. Yet, the 2000 total is still 47.8 percent lower than the 1988 one (see Table 4). In some cases, this cut involved necessary streamlining. In others, it implied a serious loss of useful knowledge (including tacit knowledge)[29] and skills developed and accumulated over time. Clearly, it would not be possible to reproduce these intangible assets immediately when funds are increased. No reliable estimates are readily available on the share of necessary streamlining and severe loss. Furthermore, the composition of total R&D personnel has also changed: as opposed to the late 1980s the number of researchers and engineers has exceeded that of the supporting staff. In some cases, this is a step towards increased efficiency but in others it causes inefficiency at a social level. When the lack of supporting staff forces highly qualified scientists to perform simple tasks, instead of solving scientific problems, which is what they are trained for, that is obviously a waste of expensive resources.

Given the underlying principles of a market economy, some observers and politicians expected firms to play a decisive role in financing and executing R&D and, in turn, the government's share to fall. Quite the opposite shift occurred in 1990-94. In fact, it is not even surprising if one takes into account the broader economic trends.

In the early 1990s most Hungarian companies were suffering from the loss of markets for two principal reasons, namely the collapse of the CMEA, their former major market, and the swift import liberalisation. Hence, their sales declined dramatically (by up to 75 percent in some industries) compared to the last pre-transition years of 1988-89. Shrinking revenues then prevented them from generating

Table 3: Gross Domestic Expenditure on R&D (GERD), 1990-2000, Current Prices

GERD	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Forints, billion	33.3	26.7	31.0	34.7	38.9	41.2	44.9	61.7	68.6	78.2	105.4
GERD/GDP (%)	1.46	1.06	1.04	0.97	0.88	0.73	0.65	0.72	0.68	0.69	0.82
GERD per capita*	123.3	79.1	81.0	78.0	74.0	66.5	60.7	71.0	71.1	77.1	n.a.

Note to Table 3: * current USD at purchasing power parity (PPP).

Source: OECD Main S&T Indicators

Table 4: R&D Personnel in Hungary, 1988-2000, Full-time Equivalent

	1988	1992	1995	1996	1997	1998	1999	2000
Total R&D personnel	45,069	24,192	19,585	19,776	20,758	20,315	21,329	23,534
of whom scientists and engineers	21,427	12,311	10,499	10,408	11,154	11,731	12,579	14,406
Other staff*	23,642	11,881	9,086	9,268	9,604	8,584	8,750	9,128

Note to Table 4: * Includes technicians, assistants, administrators etc.

Source: Research and Development (CSO), various years.

Table 5: Breakdown of GERD by Sources, 1990-2000, Percent

Funding sources	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Business	38.8	40.3	31.3	28.6	28.7	36.1	37.4	36.4	37.8	38.5	37.8
Government	58.6	55.8	62.9	65.1	63.0	55.1	51.2	54.8	54.7	53.2	49.5
Other domestic		2.1	2.9	3.9	4.7	4.1	6.9	4.6	2.8	2.7	2.1
Foreign, int'l		1.8	2.9	2.4	3.6	4.7	4.5	4.2	4.7	5.6	10.6

Source: Research and Development (CSO), various years.

adequate funds for R&D (see Table 5) and investment. Another element of the explanation is that privatisation only started in 1990 and it always takes time to find investors. In that period, however, managers were not in the position to make decisions on long-term issues, including R&D and innovation, for two reasons. First, it would have been somewhat hostile to the would-be owners to tie their hands, which, in turn, would have made the relationship between the (prospective) owners and managers uneasy. Not surprisingly, managers did not want to cause this type of conflict. Second, managers were overwhelmed by the preparations for privatisation (which included restructuring and cost-cutting), *i.e.* by short-term issues. In brief, uncertainties related to the prospective privatisation of companies also hindered R&D until the mid-1990s.

Then the share of business R&D expenditures in GERD jumped almost 8 percentage points in 1995, and thereafter it has remained at around 38 percent (see Table 5). Significant differences among companies should also be noted. Foreign-owned firms do spend more on R&D than domestic ones. The share of foreign affiliates in Hungarian BERD (business enterprise expenditure on R&D) grew from 22.6 percent in 1994 to 78.5 percent in 1998 (OECD 2001b). Moreover, foreign-owned firms can also rely on the R&D results achieved or purchased by their parent company.

Obviously, the share of government R&D expenditures changed in the opposite direction in the meantime, and by 2000 it had dropped below 50 percent. An important factor to account for this change is the fact that funding from international sources significantly increased in 1999-2000 (see Table 5), notably from the 5th Research, Technological Development and Demonstration (RTD) Framework Programme of the EU.

Given the drastic microeconomic adjustment in the early 1990s, the number of R&D units operated by firms first sharply decreased, and has then risen considerably after the mid-1990s.[30] A number of large, foreign-owned firms have either substantially increased R&D spending at their existing R&D units or set up new R&D facilities, especially since 1997-98.

The expanding number of R&D units in higher education is also worth noting (see Table 6).

A simple analysis of the distribution of researchers by sector corroborates the above observations (see Tables 7 and 8). The total number of researchers was still slightly below the 1991 level in 2000 (0.4 percent lower), but there was almost 40 percent growth in the 1996-2000 period. The higher education sector was a clear winner with nearly a 20 percent increase in absolute numbers by 2000 compared to 1991, and a massive 51.7 percent expansion since its lowest level in 1996. Thus, the share of this sector also grew from 34 percent in 1991 to above 40 percent in

Table 6: Number of R&D Units, 1990-2000

Type of organisations	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Research institutes	69	68	68	68	63	61	73	80	74	66	121
Higher education	940	1,000	1,071	1,078	1,106	1,109	1,120	1,302	1,335	1,363	1,421
Firms	174	124	98	178	183	226	220	246	258	394	478
Other*	73	65	50	56	49	46	48	51	58	64	-
Total	1256	1,257	1,287	1,380	1,401	1,442	1,461	1,679	1,725	1,887	2,020

Note to Table 6: * Includes R&D units operated at national and regional archives, libraries, museums, hospitals and ministries; since 2000 reported as part of Research Institutes.

Sources: Research and Development (CSO), various years.

2000. The government sector was the most stable one, losing less than 7 percent in absolute numbers in 1991-1996, but gaining almost 11 percent in 1991-2000, and slightly above three percentage points in terms of its weight throughout the decade. Although the business sector also showed spectacular growth (close to 50 percent) in absolute numbers in 1996-2000, it contracted by the same extent in the first six years and hence lost over a quarter of its researchers when 2000 is compared to 1991. Its share, therefore, dropped by almost 10 percentage points by 2000, which does not seem to be a favourable development from the aspect of innovation. Thus, a recent scheme aimed at encouraging private investment in R&D (see Table 2) is indeed addressing a crucial issue.

Regarding the output of R&D, the number of patents registered in the United States is frequently used as a reliable and comparable indicator.[31] Several former CEE states were split in the 1990s, therefore, to preserve data for comparison, figures for former Czechoslovakia and the Union of Soviet Socialist Republics (USSR) are also included.

Table 9 shows interesting trends and ratios. In 1989 two countries performed relatively well: the USSR and Hungary. Besides the turmoil of transition, this picture has remained practically the same throughout the 1990s. If the size of countries is also considered, two Central European countries can be highlighted: Hungary and Slovenia.[32] Slovenia, however, spends considerably more on R&D than Hungary: roughly three times more *per capita* every single year since 1994 (*e.g.* in 1999 240 and 78 current USD — at Purchasing Power Parity — respectively).

Although business R&D expenditures have picked up since 1996-97, firms do not spend a lot on R&D. However, fierce competition, in both export markets and the open, liberalised domestic one, compels them to innovate. Indeed, they introduce new products and/or processes, otherwise they would not have survived, but in most cases these innovations are not based on domestic R&D projects. Quite often they rely on technologies provided by parent companies or other foreign partners, *e.g.* under a subcontracting agreement. Foreign firms are also encouraging their Hungarian suppliers to introduce new managerial techniques and other organisational innovations.[33] Joining the international production networks, especially in

Table 7: Number of Researchers by Sector, 1991-2000, Full-time Equivalent

	1991	1995	1996	1997	1998	1999	2000
Business enterprises	5,341	2,926	2,626	3,049	3,044	3,261	3,901
Government	4,204	3,529	3,925	3,911	4,289	4,550	4,653
Higher education	4,926	4,044	3,857	4,194	4,398	4,768	5,852
Total	14,471	10,499	10,408	11,154	11,731	12,579	14,406

Sources: Research and Development (CSO), various years.

Table 8: Trends in the Distribution of Researchers by Sector, 1991-2000, Percent

	share in 1991	share in 2000	percentage change 1996/91	percentage change 2000/91	percentage change 2000/96
Business enterprises	36.9	27.1	49.2	73.0	148.6
Government	29.1	32.3	93.4	110.7	118.6
Higher education	34.0	40.6	78.3	118.8	151.7
Total	100.0	100.0	71.9	99.6	138.4

Sources: author's calculations, based on Research and Development (CSO), various years.

electronics and automotive industries, has also opened up the gates of the global markets for Hungarian firms. Domestic innovative activities outside the domain of formal R&D do play an important role, too, *e.g.* engineering and re-designing to adjust to local needs and production facilities, as well as upgrading production equipment and tooling up to increase efficiency and/or to introduce new products and processes.

The harmonised OECD-EU innovation survey (CIS — Community Innovation Survey) has not been conducted in Hungary yet, and thus data on innovation activities are unavailable. An indirect method, however, provides straightforward results. Trade data show a radical restructuring both in terms of the main export markets — a swift move towards the overriding share of the EU (see Table 10) — and in the composition of exported goods, namely, a move towards higher value-added products. Meat and semi-finished products had been "dethroned" by telecom equipment, electric, energy generation and office machinery by 2001 (see Table 11). This remarkable performance in such competitive markets could have not been achieved without strong innovation performance.

It should also be added that the pressure to innovate is eventually leading to more intense formal R&D activities. The first clear sign of this is that FDI has significantly contributed to strengthening

Table 9: Central European and Russian "Utility Patents" Granted in the USA, 1963-2000

	pre 1987	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1990 - 2000	total
Croatia	-	-	-	-	-	-	0	2	1	6	4	4	13	16	6	52	52
Czech Rep.	-	-	-	-	-	-	-	0	1	1	5	14	13	24	23	81	81
Hungary	1469	127	94	129	93	85	88	61	46	50	43	25	50	39	36	616	2435
Poland	537	13	8	14	17	8	5	8	8	8	15	11	15	19	13	127	699
Slovak Rep.	-	-	-	-	-	-	-.	-	0	0	1	3	2	5	4	15	15
Slovenia	-	-	-	-	-	-	0	3	6	4	10	7	18	10	16	74	74
Russian Fed.	0	0	0	0	0	0	0	3	38	98	116	111	189	181	183	919	919
USSR	6037	121	96	161	174	178	66	65	53	12	16	4	6	3	1	578	6993
Czechoslovakia	1847	46	33	34	39	27	17	13	19	15	8	9	9	5	9	170	2130

Notes to Table 9: Patent origin is determined by the residence of the first-named inventor as displayed on the face of each patent. The USPTO definition of 'Utility Patent': Issued for the invention of a new and useful process, machine, manufacture, or composition of matter, or a new and useful improvement thereof, it generally permits its owner to exclude others from making, using, or selling the invention for a period of up to twenty years from the date of patent application filing, subject to the payment of maintenance fees. Approximately 90 percent of the patent documents issued by the USPTO in recent years have been utility patents, also referred to as 'patents for invention'. Design, plant and reissue patents are not included in this count. The mark "-" means not applicable (the country did not exist).

Source: United States Patent and Trademark Office (USPTO).

Table 10: Share of the EU/EC Countries in Hungary's Foreign Trade (Percent)

	1989	1994	1999	2000	2001
Exports	24.8	51.0	76.5	75.1	74.2
Imports	29.0	45.0	64.0	58.4	57.8

Sources: Central Statistical Office (1989-1999), Ministry of Economic Affairs (2000-01).

the formerly relatively weak and *ad hoc* business-academia links. In other words, foreign firms have increasingly realised that their competitive performance can be maintained more easily if they rely not only on their home R&D labs, but also on the knowledge of Hungarian researchers, either by hiring them[34] or co-operating with university departments and R&D institutes.

Policies should facilitate process, *i.e.* the "re-coupling" of domestic R&D and innovation for a number of reasons. First, exporting local firms, without maintaining a strong innovation performance, are likely to lose their markets in the medium-term. Of course, they can rely on the R&D results of their foreign partners in the future, too — as they tend to do now — but pursuing this strategy would result in a weakening position *vis-à-vis* their foreign partners. At best, it can only be a strategy for stagnation, but their foreign partners might opt for other partners in other countries (with lower production costs), unless the Hungarian suppliers improve their own innovative capabilities, *i.e.* offer something for a new, long-term partnership. There are other sources of innovation, too, *e.g.* in-house, non-R&D activities or R&D results of local university departments and other research units. Yet, an important outcome of in-house R&D activities is to acquire knowledge about developments at the technological frontier (by following others' activities, reproducing their experiments, *etc.*), and thus to learn what to adapt and improve adaptive, innovative capabilities (Levin *et al.* 1987). Without conducting some in-hose R&D activities, these types of knowledge, capabilities and skills cannot be accumulated, and hence less efficient decisions can be made as to what technologies should be acquired, and the necessary adaptation would also be slower and more costly.

The second challenge is the low share of foreign-owned exporting firms conducting R&D in Hungary. Only 23 of the top 100 exporting companies conducted R&D activities in Hungary in 1999, of which 14 were owned by foreign investors. However, altogether 63 of the top 100 exporting firms were foreign-owned. This means that — in terms of numbers — only 22 per cent of the large, foreign-owned, exporting companies carry out R&D activities in Hungary (TEP 2001). Again, without a more intense link with the local

Table 11: Share of the Top 10 Commodity Groups in Hungarian Exports (1990, 2001)

1990		2001	
Commodity groups	Share (percent)	Commodity groups	Share (percent)
Meat products	10.1	Telecommunications equipment	12.6
Chemical semi-finished products	8.6	Electric machinery and components	11.9
Steel semi-finished products	7.1	Energy generation machinery	10.7
Clothing	6.8	Vehicles	8.9
Vehicles	4.8	Office machinery	8.3
Metallurgical raw materials	4.2	Clothing	4.4
Canned fruits and vegetables	3.3	Other processed products	2.9
Chemical raw materials	3.2	General machinery	2.9
Metal semi-finished products	2.3	Metal products	2.2
Pharmaceuticals	1.7	Meat and meat products	2.2
Total	52.1	Total	67.1

Sources: Foreign Trade Statistical Yearbook, 1990 and Press Release on Foreign Trade, January-December 2001, preliminary data, Ministry of Economic Affairs and Ministry of Foreign Affairs, 22 February 2002.

R&D system, they might find other locations with lower production costs even in the space of a few years, and relocate their activities.[35] Thus, both jobs and export revenues would be lost, causing macroeconomic and social tensions. One way to "anchor" them is to provide appropriate incentives to set up their own, in-house R&D activities — employing Hungarian scientists and research engineers — and/or foster their links with local R&D units.

Conclusions

The political and economic transition posed a complex, tremendous challenge in Hungary at the beginning of the 1990s. Not only macroeconomic stabilisation was required, but fundamental organisational and institutional changes were also needed to transform the country into a stable, middle-income economy, capable of catching up with the more advanced ones in the longer run.

Science, technology and innovation policies are no doubt the cornerstones of any successful catching up strategy as, for example, the case of the East Asian "tigers" clearly shows (Hobday 1995). Yet, in the current Hungarian context it also means that a number of Herculean tasks have to be performed at the same time, each being demanding not only from a financial point of view, but also politically and intellectually. These issues, then, compete for the attention of politicians and policy-makers as well as public funds.

Faced with all these challenges, not surprisingly, Hungary's performance has been mixed. The crucial institutions of a market economy have been put in place relatively quickly and after some hesitation a successful, but — largely due to the delay involved — harsh macroeconomic stabilisation programme has also been implemented. Some important legislative changes have occurred in the field of higher education and intellectual property rights, too. Government S&T bodies, however, seemed to lose their political clout throughout the 1990s. As for policy, although R&D expenditures and staff were severely cut up to 1995-96, the science community has always exerted some influence on public policies. As an unmistakable sign of this, the government has recently approved an ambitious science policy document that shifts the structure of overall R&D spending towards "basic science"-type projects. Technology policy schemes have also been substantially renewed since the early 1990s, and "hidden" among these tools, some elements of innovation policy have gradually been introduced, especially since the late 1990s.

Yet, attempts to devise and implement a coherent set of policies to strengthen the innovation system "consistently" failed throughout the 1990s, regardless of the political stance of the actual governments in office. Pressures stemming from macroeconomic imbalances requiring immediate actions, intellectual and financial resources, the socio-psychological legacy of central planning as well as illusions and policy misconceptions all contributed to this. As a clear indication of policy-makers' (lack of) interest in innovation, the harmonised OECD-EU innovation survey has not yet been conducted in Hungary (as opposed to Poland and Slovenia, to mention other EU candidate-countries). Therefore, innovation efforts and their outputs cannot be measured. It is also telling that only a tiny research community works on issues relating to science, technology and innovation; there is simply no demand for thorough, regular policy analysis. The lack of data and reliable analysis on innovation performance, however, poses a significant threat: policies are more likely to be influenced by pressure groups and short-term political considerations than by a sound understanding of the impacts of foregoing decisions and current (as well as foreseeable future) socio-economic needs.

An even more worrying possibility is that the lack of explicit innovation policy may hinder long-term development. Evolutionary economics of innovation clearly shows that policies aimed at improving learning capabilities, facilitating institution and network building, as well as communication and co-operation among the key players are of crucial significance. Concerted efforts, both public-private partnership and co-operation among compartmentalised government agencies, are further keys to success. Here lies the importance of a thoroughly devised innovation strategy: *via* explicitly targeting networking and communication it can contribute to creating the preconditions for co-operation and to channel financial and intellectual resources to achieve the jointly set goals. In other words, it can signal the main policy directions and commitments of the government. Further, it provides an appropriate framework to understand that enhancing competitiveness and improving the quality of life is a complex task. It requires various types of efforts and factors, among others, education and life-long learning, research and development, appropriate legal, organisational, knowledge and physical infrastructures, institutions to facilitate close co-operation among the key players, and these inputs can be used more efficiently in a co-ordinated way. The lack of such a strategy, in turn, is indeed a major concern.

Yet, one can "detect" the emergence of an IMPLICIT innovation policy in Hungary when taking a closer look at the technology policy tools administered by the R&D Division of the Ministry of Education. There is a severe shortcoming, however. These are, by definition, schemes of a single government body. They cannot be mistaken for the tools of a concerted, overarching innovation policy approved by the government as a whole, and thus "mobilising" the resources of various government departments into the same, jointly discussed and agreed direction.

Beyond the lack of an explicit innovation policy, the recent "relegation" of the OMFB, the formerly (semi-)independent government agency, signals an even worsening situation. The former Council of the OMFB, consisted of high-ranking officials of interested ministries, representatives of the research and business communities, was a decision-making body. It was, therefore, an important forum for co-ordinating the research, technological development and innovation-related efforts of various government departments. Since January 2000 this is no longer the case as this body has been stripped of its decision-making rights. Nor can it serve as an influential communication channel between policy-makers, researchers, business people and innovation experts as its "demotion" has obviously led to shrinking prestige.

The theoretical arguments of evolutionary economics of innovation, together with the lessons of successful "catching-up" economies, all point to the importance of an explicit innovation policy to improve economic performance, and thus for providing the means for a higher standard of living. Hungary's case has so far shown that a country can escape the immediate consequences of not having one, but most likely only for a limited period, and given some lucky coincidences. The direct disadvantages can, at least partially, be rectified by a fortunate set of factors and these have all been present in Hungary:

— an extreme inflow of FDI, bringing in technological, organisational and managerial innovations in bulk, more recently also organising suppliers' networks and strengthening academia-industry links;

— coupled with a previously strong, albeit severely hit, R&D system, which, relying on both its previous strengths and the current radical restructuring, is still churning out useful research results as well as skills required by multinational firms; and
— helped by a systematic technology policy, assisted by elements of an implicit innovation policy (*e.g.* the CRC and Integrator schemes, as discussed in the subsection on "Implementation").

By definition, the long-term drawbacks cannot be felt immediately. The above, currently favourable set of factors, however, are unlikely to hold without systemic, thoroughly devised efforts, and thus the temporary positive outcomes may be lost. This is a one-off, "shaky" situation, indeed. Foreign firms can move easily whenever they find more attractive locations. They can close down their plants entirely, or leave only their obsolete technologies and low-wage, simple tasks in Hungary. That would spell a fatal blow not only to the still fragile R&D system, but also to their suppliers and then hardly any applicants would survive to make use of technology policy schemes, regardless of their sophistication.

By reshaping and considerably strengthening the national innovation system, building the appropriate supporting knowledge and physical infrastructures the current, temporary advantages can be converted into lasting ones. And these are precisely the tasks of an explicit innovation policy. For example, stronger co-operations among firms, as well as between firms and R&D institutes are advantageous for all parties (as shown by a vast body of literature, *e.g.* Ergas 1987; Nelson 1993; Dodgson and Bessant 1996; Edquist 1997; Freeman and Soete 1997; OECD 1997; 1999; 2001a; Lundvall and Borrás 1999). Further, operations of the "enlightened" foreign firms, *i.e.* those interested in building long-term, mutually beneficial relationships in Hungary, as opposed to exploiting short-term cost advantages, can be "anchored" by, among other tools, fostering the emergence of knowledge-intensive services. Their favourable impacts on the Hungarian economy can thus be strengthened and maintained.

To sum up, an explicit innovation policy is perhaps even more needed in a transition country, where most of the previous organisations have to be radically reshaped, new ones established, communication and co-operation strengthened *etc*., than in an advanced country. The Hungarian case also offers a bitter and sobering lesson: the likely positive impacts of an explicit innovation policy are indirect, occur through many "transmissions", and mostly in the medium or even long run. It is, therefore, a rather demanding task to account for the outcomes of these efforts, whereas the lack of them can be eclipsed by the results of some favourable, albeit temporary, conditions. Politicians, by contrast, usually apply a much shorter time horizon to their decisions. For these reasons, it is very difficult to convince them that they should instruct policy-makers to devise and implement a coherent, overarching innovation policy. This then becomes almost impossible when decision-makers (both politicians and policy-makers) are working under the tremendous pressures of transition and trying to solve immediate problems.

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Notes:

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1 See, *e.g.*, Nelson and Winter (1982), Ergas (1987), Dosi (1988), Levin *et al*. (1987), Dosi *et al*. (1988), Foray and Freeman (1992), Lundvall (1992), OECD (1992; 1997; 1999; 2001a), Nelson (1993; 1995), Freeman (1994), Gibbons *et al*. (1994), Grupp (1998), Edquist (1997), Freeman and Soete (1997), Metcalfe and Georghiou (1998), Lundvall and Borrás (1999).

2 Freeman (1994; 1995) provided a thorough literature survey on the importance of networks and the "innovation system" approach. See also Lundvall (1992), Nelson (1993), Edquist (1997), Lundvall and Borrás (1999), OECD (2001a) as well as the October 1991 and February 2002 issues of *Research Policy* (**20**(5), and **31**(2), respectively).

3 Metcalfe and Georghiou (1998:85-93) provided an overview of S&T policies in EU member-countries. See also further contributions in the special issue of *STI Review* on New Rationale and Approaches in Technology and Innovation Policy (1998, No. 22), the June 2001 issue of *Research Policy* (**30**(6)), as well as Lundvall and Borrás (1999).

4 For a more detailed analysis, see *e.g.* Havas (2002a).

5 The population in general used to be accustomed to stability, especially in terms of job security as well as extended social services: health, education, pension, seemingly at no cost. In reality, of course, all these services were financed by the population in the invisible way of retained salaries, rather than through "visible" income and sales taxes. On the whole, a relatively high standard of living was maintained in Hungary, especially since the late 1960s compared to other Central and Eastern European (CEE) countries, but to a large extent financed by foreign loans that also had to be serviced in the transition period (Antal 1998a; 1998b; Farkas 1998; TEP 2001; Havas 2002a).

6 A detailed description and analysis of these "stop-go" type cycles can be found in Antal (1998a; 1998b), Farkas (1998), Halpern and Wyplosz (1998), and TEP (2001).

7 The stock exchange was re-opened in 1989, *i.e.* before the political transition.

8 Council for Mutual Economic Assistance, the trade organisation of the former Soviet bloc.

9 For a more detailed account of these changes, see Balázs (1994), Inzelt (1996) and Havas (1999; 2001).

10 Yet, its members are still appointed by the prime minister as stipulated by the former legislation. It clearly shows that: (i) it was a relatively hasty decision — without the due professional and even legal preparations — to "downgrade" the status of the former OMFB from being a government agency to a division of a ministry; and (ii) the government most likely wanted to avoid the proper parliamentary debate required to pass any amendment to the legislation on the former OMFB and OMFB Council. Thus, the name of the Ministry of Education has not been changed either — it would also have required amending another law, and hence parliamentary debates — despite its considerably extended responsibilities.

11 Civil servants (who wish to remain unnamed) also recall that even the term "innovation" was "banned" in the first few months of 2000, just after the absorption of the former OMFB within the Ministry of Education.

12 Especially the third one is puzzling: one can think of the absorptive capacity of businesses either in terms of investment or innovation, but not that of R&D institutes.

13 See *Program for the Support of Research, Development and Innovation* available at http://www.gm.hu/kulfold/english/angol/2_4.htm (14 March 2002).

14 TEP results were published electronically in 2000 (see http://www.tep.hu, November 2002). The Steering Group and the seven thematic panels assessed the current situation, outlined different visions (scenarios) for the future, and formulated policy proposals. The thematic panels analysed the key aspects of the following areas: Human resources; Health and life sciences;

Information technology, telecommunications and the media; Natural and built environments; Manufacturing and business processes; Agribusiness and the food industry; Transport. As for the aims, methods and other details of the TEP see Havas (2002b).

15 The Delphi method is often used in foresight programmes. It is an iterative survey of expert's opinion on particular developments/events that are likely to happen in the areas being studied. The major distinctive feature of a Delphi-survey is that the same questionnaire should be filled in several times, but when experts reply again, they would see the aggregate results — the distribution of opinions — of the previous round. This way they can learn about each other's opinion, and can take into account those pieces of information when replying to the same questionnaire in the following round, but without being unduly influenced by position, prestige or dominant personalities as the results are anonymous. After 2-3 rounds, opinions tend to converge, *i.e*. a consensus is emerging. Of course, dissenting views might be as important as the majority opinion. For a more detailed explanation, see e.g. Cuhls *et al.* (2002) and http://www.surveying.salford.ac.uk/idsin/delphi.html (29 November 2002).

16 It was only possible to categorise five panels' statements (out of seven), using the British typology (elucidation, prototype, first practical use or widespread practical use of a product) as a starting point. Even in these cases a number of categories had to be added, *e.g.* human resources, organisational innovation, regulation and institutions. For further details, see Havas (2002b).

17 The limited results are reported in Havas (2002b). The new government, taking office in June 2002, seems to pay more attention to the TEP results. A new National Development Plan (NDP), drafted as part of the EU accession (only available in Hungarian at http://www.euregio.hu/nft, as of 29 November 2002), heavily relies on the TEP visions. Perhaps even more importantly, the underlying principles of this new document are relatively close to those advanced and advocated by the Steering Group report. However, the "devil is in the details". Thus, one should wait and see the so-called operative programmes of the NDP and their implementation before rushing into any premature, superficial assessment.

18 For data and more detailed analyses on these issues, see OECD (1993), Pungor and Nyiri (1993), Inzelt (1995), Havas (1999; 2001), and TEP (2001).

19 Another serious weakness of this type of reasoning — purely from a professional point of view — is the neglect of the overall framework: even fairly similar projects, say upgrading of production equipment in certain industries, would lead to relatively different outcomes in distinct economic systems. Real decision-making processes, however, rarely rely exclusively on rational, professional considerations; they are "coloured" with value-judgements and a host of other subjective determinants and it would be a serious mistake of any analysis not to realise this fact of life.

20 For data and more detailed analysis on these issues see the sub-section on R&D and innovation performance.

21 OTKA was established in 1991 to support basic research projects, young researchers' projects and R&D infrastructure development (see also http://www.otka.hu, November 2002)

22 The goal of these schemes, called Széchenyi and Bolyai grants and aimed at different age groups, is obviously to curb brain-drain.

23 FEFA promotes the development of new higher education curricula and infrastructure, especially hardware, software and network investments. It is supervised by the Ministry of Education.

24 Some of these tools were available only in either 2000 or 2001, due to a lack of funds. However, the aim of this sub-section is just to give a "flavour" of the various schemes applied, *i.e.* not to provide a rigorous "financial audit". For previous years, when somewhat different underlying principles were followed, see *e.g.* Havas (1999).

25 For a more detailed account, with some preliminary assessment, see Havas (2001).

26 It should also be added that OECD methodologies to collect and interpret R&D data have only been applied strictly since 1994. Thus, a direct comparison between the periods until 1993 and from 1994 should be taken with a pinch of salt. The sharp decline in the figures for R&D spending, however, has not been caused by the application of the new methodology: it is a genuine phenomenon, not just a misleading statistical observation.

27 The European Commission has urged them for quite some time to increase this ratio in order to

catch up with the United States and Japan (see, *e.g.* EC 1996) The latter two countries spent 2.5-3 percent of their GDP in 1985-1999 (OECD 1998; 2000). Recently, the EU Summit held in Barcelona in March 2002 decided to raise the GERD/GDP ratio to 3 percent by 2010.

28 The first few years of the transition process, *i.e.* 1990-92, were specifically harsh in this respect, too.

29 On the importance of tacit knowledge see, *e.g.* Lundvall and Borás (1999) and the special issue of *Industrial and Corporate Change* (**9**(2)) on the economics of knowledge.

30 Besides economic reasons behind this trend, there might also be some methodological ones. Given the organisational and ownership changes occurring on a massive scale, the Central Statistical Office might not have reached a number of companies up to the mid-1990s. Moreover, a number of those reached by the CSO survey may not have answered.

31 One also has to bear in mind, however, that certain inventions cannot be patented and some inventors do not file patent applications (due to a lack of funds or knowledge of the importance of patenting). For a more detailed analysis see, *e.g.*, Levin *et al*. (1987).

32 Hungary's population (10 million people) is five times bigger than Slovenia's.

33 For a more detailed analysis of the major automotive cases, see Havas (2000b).

34 Major international companies set up new R&D units in Hungary (including Nokia, Ericsson, Knorr Bremse and Audi) or expanded the existing, "inherited" ones (*e.g*. General Electric and Chinoin) in the second half of the 1990s.

35 When revising this article, IBM announced on 22 October 2002 to close down one of its Hungarian subsidiaries in Székesfehérvár, IBM Storage Products Ltd. It is a significant loss to the Hungarian economy as IBM Storage Products Ltd, employing 3700 people, was the second largest exporting firm in 2001, with a 7.5 percent share in the total Hungarian exports (nol, népszabadság online, http://www.nepszabadsag.hu, 22 October 2002).

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