EU Enlargement and Innovation Policy in Central European Countries: The case of Hungary

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1 INTRODUCTION

Hungary, just as all the other Central European countries (CECs), is facing a number of interrelated challenges: the changing dynamics of globalisation and the concomitant re-arrangement of the international division of labour, as well as joining the European Union, where cohesion with the more developed members is a crucial issue for both the EU and national policy-makers. The starting point of this paper is that innovation – new technological, organisational and managerial solutions – is a must to enhance international competitiveness and thus improve quality of life. Although innovation is mainly matter for companies, public policies should assist the creation, exploitation, and diffusion of knowledge. Science, technology and innovation (STI) policies, therefore, can, and indeed should, play a significant role in meeting the above challenges – together with a host of other policies, such as education, competition, industrial, investment promotion, regional development and trade policies.

Recent STI policies pursued in Hungary are assessed from this perspective. Thus, this chapter first puts STI policy issues into context by summarising the major challenges faced by policy-makers. To provide some background information on the policy formation process, albeit not a detailed sociological account, Section 3 describes the roles and responsibilities of the various actors in the Hungarian STI policy community. Policy schemes are then discussed in Section 4. As policy misconceptions can easily lead to inappropriate spending of public money, some of the widely held mistaken believes are reviewed in Section 5, also serving as a basis for conclusions summarised in the final section.

The conceptual framework of this paper relies on the evolutionary economics of innovation.[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 levels. 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

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[1] See, *e.g.*, Dosi (1988), Dosi *et al*. (1988), (1994), Dodgson and Bessant (1996), Dodgson and Rothwell (1994),

[2] Freeman (1991), (1994) and (1995) provided a thorough literature survey on the importance of networks and the innovation system approach. See also Edquist (1997), Lundvall (1992), Lundvall and Borrás (1999), Nelson (1993), OECD (2001b) as well as the October 1991 and February 2002 issues of *Research Policy* (Vol. 20, No. 5, and Vol. 31, No. 2, respectively).

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, p. 84) Indeed, a recent STI policy trend in advanced countries is 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]

Another major policy implication of this analytical framework is that conscious, co-ordinated policy efforts are needed to promote knowledge-intensive activities in all sectors, with the explicit goal of upgrading firms' capabilities, and thus improving their overall competitiveness. In other words, despite of the wide-spread believes in the 'magic' and automatic impacts of the so-called high-tech industries on economic growth, policy-makers should be aware of the importance of knowledge-content in the low- and medium-technology (LMT) industries, too. Just to prevent some potential misinterpretations, it should be stressed in the outset that this paper is not intended, of course, to advocate a 'low-tech development path' for CECs, or to 'relegate' them to the second or third technology division with low competitiveness, and hence low living standards.

A recent EC document also draws to the attention of policy-makers to this conclusion in a balanced, succinct way: "The EIS [European Innovation Scoreboard] has been designed with a strong focus on innovation in high-tech sectors. Although these sectors are very important engines of technological innovation, they are only a relatively small part of the economy as measured in their contribution to GDP and total employment. The larger share of low and medium-tech sectors in the economy and the fact that these sectors are important users of new technologies merits a closer look at their innovation performance. This could help national policy makers with focusing their innovation strategies on existing strength and overcome areas of weakness." (EC, 2003, p. 20)

For these reasons the paper would discuss a broad(er) range of policy schemes, i.e. not just the ones aimed at promoting 'high-tech' fields, e.g. information and communication technologies, biotechnology.

2 BACKGROUND OF NATIONAL STI POLICIES

2.1 Accession to, and cohesion within, the European Union

The challenges confronted by Hungarian policy-makers have much in common with those in other CECs, and this section, therefore, discusses these issues at a higher level of aggregation, that is, at a regional – as opposed to a country – level. The reintegration into the political and economic systems of Europe – that is, accession to the European Union – has posed a complex, tremendous challenge for CECs since the beginning of the 1990s. First, the demanding and socially rather costly process of political and economic *transition* had to be completed. Not only macroeconomic stabilisation was required, but fundamental organisational and institutional changes were also needed to transform these countries into stable, middle-income economies, capable of catching up with the more advanced ones in the

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[3] Metcalfe and Georghiou (1998, p. 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* (Vol. 30, No. 6), as well as Lundvall and Borrás (1999).

longer run. These sweeping changes have been reflected in the ownership, production, employment and trade structures in CECs, albeit at a different speed, and sometimes taking country-specific routes. These economies, in practice, have already been integrated into the EU in various ways – via foreign trade links, by joining international production networks, as well as by ownership links – to a large extent, even before becoming member states.

In the meantime, *accession* negotiations have been completed by the end of 2002. Harmonisation of written rules has absorbed a large chunk of administrative resources, indeed. Yet, adapting and adjusting the institutions, values and behavioural rules, most likely remains a daunting task well after the formal entry into the EU.

In other words, the real challenge is not just to achieve formal membership, but *cohesion* with the advanced, core member states of the EU. Having completed the first round of transition, CECs have again reached a cross-road. While the one-party system has been replaced with a multi-party parliamentary democracy and the planned economy with a market economy based on private ownership, the world economy, as well as the EU itself, have significantly changed during this historically short period. Moreover, the EU is going to be reshaped not just because of the global, structural changes, but also due to the very process of enlargement.

CECs now have to consider what role to play in the globalising learning economy: do they passively accept the fate of a merely surviving economy, drifting without having their own strategy, just hoping for extended and extensive EU assistance? Or, by implementing a sound and well-articulated strategy, do CECs intend to be prosperous countries in 15-20 years? In that future their citizens would enjoy high living standards, good health and a clean environment, and to sustain that, companies would become strong competitors, and thanks to that, CECs would become net contributors to the EU budget, supporting the cohesion of the even larger EU and its co-operation with neighbouring countries.

The inherent contradiction of the transition process lies in the tension between the short-term and long-term issues, which have to be tackled simultaneously, while intellectual and financial resources have not been sufficient to deal with all these issues in the same time. Given the planned economy heritage, it was not only the 'usual' macroeconomic stabilisation that was required in CECs at the beginning of the 1990s, but also a much more challenging, more complex modernisation programme introducing fundamental structural, institutional changes. In other words, systemic changes were required in order to transform CECs into viable economies, capable of economically, socially and environmentally sustainable development.

Now the question is that by joining the EU, and experiencing the impacts of the global changes[4] would be strong enough signals to shift the attention of policy-makers towards strategic thinking, i.e. somewhat away from 'fire fighting' (assuming that there would be no major 'burning' issues).

Would it also cause a change in the perceived role of research, technological development and innovation (RTDI)? It might seem to be an odd question in advanced countries, where RTDI activities are understood as one of the major means for enhancing international competitiveness and improving quality of life, and thus playing a crucial role in socio-economic development. In CECs, however, R&D is put into a different basket as it is largely regarded as a luxury item. Some high-ranking policy-makers – e.g. the former President of the

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[4] Some foreign firms are already relocating their activities from CECs to China and other Asian countries or Eastern European ones.

Hungarian Academy of Sciences[5] (1996-2002), who was a minister of cultural affairs just before the transition – still writes about 'science and cultural policy', without ever mentioning innovation. (Glatz, 2002) The same author has also coined a new term, 'enterprise science policy'; just to avoid using the well-known – and correct – term of innovation strategy. (Glatz, 1998, pp. 42-44) In a similar vein, he speaks of the science policy of the EU – and not of STI policies and RTD Framework Programmes. (Glatz, 1998, pp. 44-46, 111-114) A long list of similar statements can be compiled, e.g. at a UNIDO meeting, held as recently as December 2003, high-ranking officials of the Bulgarian and Rumanian Academy of Sciences claimed that the only source of knowledge is basic research. It is not just a pedantic remark in an obscure, doctrinaire academic dispute to point out how inappropriate these notions are. This sort of terminology clearly shows that policy-makers do not realise the link between economic development and RTDI efforts. They disconnect R&D and innovation, and hence assume that R&D expenditures can be cut without serious socio-economic consequences. This way of thinking is partly a legacy of the planned economy period, when return on R&D expenditures was a non-issue: R&D activities were primarily conducted for military purposes and the remaining, smaller, part was financed to boost prestige.

The practical repercussions of all these are rather severe: whenever austerity measures had to be introduced in CECs in the last 15 years to balance the central budget, RTDI expenditures were always among the first targets. In other words, it is a counter-productive strategy to put innovation into the shade and talk only about 'science': instead of securing more funding, the likely outcome is that RTD(I) activities would always be financed from the residue of the central budget, once all the 'important' objectives are funded. More importantly, the real issue, that is, exploiting RTDI results to enhance competitiveness and improve quality of life is eclipsed by this way of thinking. This out-dated, inappropriate perception of RTDI, therefore, should be changed.

2.2 Transition challenges: the need for innovation

Innovation can and should play an important role in solving some of the major transition challenges. Loss of former markets, and hence the need to find new ones, necessitates the introduction of new products, production processes and services, as well as modern managerial techniques and other types of organisational innovations to raise productivity. Pressures at the macro-level, notably severe budget, trade, balance of payment deficits, also call for a successful, competitive economy, capable of 'growing out' from these traps. Poor quality of life (considering its economic, health, environmental aspects) cannot be improved without thousands of incremental and radical innovations in a large number of fields. Finally, brain drain, which is rather harmful both from an economic and social point of view, can only be reversed, or at least slowed down, by offering attractive conditions for researchers and engineers; i.e. interesting projects, appropriate funds, much better equipment and higher income.

In sum, innovation is a must to tackle to above issues, but definitely not a panacea.

[5] Academies of Sciences in the former Soviet bloc were quasi- ministries of science, and they are still running quite a number of research institutes, financed by the state budget. Thus, their leaders are still policy-makers, and not just elected representatives of learnt societies.

2.3 Innovation system challenges

The legacy of central planning and the transition process together have caused a number of problems in the CE national innovation systems (NIS).[6] Both public and private R&D funds have been cut severely, due to austerity measures, worsened by the weak position of the funding bodies in the contest for budgetary resources. Hence, the number of research scientists and engineers, as well as that of the R&D institutes, has decreased in most CECs. In other words, brain drain has occurred both internally, in forms of skilled and experienced researchers leaving the R&D sector for other types of jobs, and externally, i.e. trained people leaving their country altogether (either for R&D or other types of jobs abroad). Lack of funding obviously made equipment increasingly obsolete – with some exceptions, of course –, while the 1990s witnessed a strong need for ever more expensive equipment to keep up with other countries.

From the point of view of catching-up, i.e. the cohesion of the enlarged EU, it is even more worrying that research and higher education are still somewhat isolated in most cases, in spite of the well-documented fact that the most important contribution of academic research to socio-economic development is training skilled labour, who can then work in various sectors of the economy, exploiting not only their scientific knowledge, but their problem-solving skills as well. (Pavitt, 1991, 1998; Salter and Martin, 2001) Another severe problem, noted at a number of meetings, and confirmed by sporadic empirical research, too, is the lack of relevant managerial skills in academia; in particular the ones required for project development, managing international projects and IPR issues, as well the exploitation of results. (Havas and Nyiri, 2004) Further, academy-industry links are still weak in all CECs, albeit to a somewhat different degree – space limits, however, prevent even a brief discussion of these differences. Capital markets have gone far, compared to the planned economy period, but are in their infancy when the needs of innovative enterprises are considered. A special aspect of it can also be seen as a chicken-egg problem: policy-makers tend to emphasise the small sums of venture capital, wile business people are likely to stress the lack of worthy projects (i.e. the lack of market opportunities/ incentives to pull together more substantial venture capital funds).

In sum, not only the various elements of CECs' national innovations systems are underdeveloped, but their NIS are poorly integrated, too. On top of that, a number of observers have identified a further obstacle to development, namely the persistence of the linear model of innovation in the mindsets of policy-makers; that is, the lack of up-to-date, relevant policy knowledge.

To conclude, drastic restructuring, learning and 'unlearning' are required in various sectors and at all levels (policy-making, research organisations, firms, individuals), i.e. a sort of 'planned, policy-assisted creative destruction' is needed. Yet, in most CECs the innovation policy constituency is small, fragile and somewhat disorganised. Moreover, the STI policy framework is bipolar (S&T or Education vs. Economy Ministries), and thus in most cases communication and co-ordination among the ministries responsible for various elements of STI policies are either lacking altogether, or rather weak. Public spending on RTDI can only be inefficient in these settings.

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[6] Space limits do not allow an extensive discussion of these issues here. More details can be found, e.g. in Acha and Balázs, 1999; Bucar and Stare, 2002; Chataway, 1999; EP, 2002; Havas, 2002, 2003; Kubielas, 2003; Meske *et al.* (eds), 1998; Müller, 2002; Nauwelaers and Reid, 2002; Reid *et al.* 2002, Radosevic, 1994, 1998, 1999; as well as the recent TrendChart country reports on CECs.

2.4 External challenges

The global movement of capital, activities of multinational companies (MNCs) and the ever more widening and dense web of international production networks pose either threats or opportunities, depending on the policies and other capabilities of a given country.

Foreign direct investment can be '*foot-loose*', i.e. characterised by low skill requirements, low-value added activities, offering low paid jobs, and ready to leave in every moment for even cheaper locations. Other types of investors, though, are '*anchored*' into a national economy: these are characterised by knowledge-intensive, high-value added activities, create highly paid jobs, build close contacts with local R&D organisations and higher education institutes, and develop a strong local supplier base.

One of the often used – but easily misleading – indicators of international comparison is the proportion of foreign firms in output, exports or employment. CECs, of course, should seize the potential benefits of learning from leading firms, gaining access to their markets, etc., so as to speed up their catching-up process. Policy-makers should understand, however, it is not the sectoral pattern of production – the weight of the so-called low, medium or high-tech industries –, but a strong NIS, clear strategic goals and conscious policy implementation, what makes a difference between countries: which one can take advantage of globalisation, which one is used just as a temporary, cheap production site, and which is left out altogether from the international division of labour. What matters is putting an appropriate policy mix in place: not single-minded research or industrial policies, favouring high-tech sectors, but co-ordinated investment, industrial, STI, education, regional development, and competition policies are required to attract the 'right type' of FDI, and anchor it for a longer period.

Another snag of investment promotion is to strike a balance between immediate, volume job creation (which usually associated with low wages and short-term plans of 'foot-loose' investors) and generating skill-intensive jobs (which are usually fewer in number, but offer higher wages, and signal longer-term commitment of the investors). An even more difficult challenge is to avoid 'rat race' among CECs for FDI. Yet, it would be a highly advantageous development as the current practice inevitably and disproportionately favours the foreign investors.

2.5 EU funds and policies: two facets

EU funds can be of a great assistance to face the above challenges if they are used in an appropriate combination with the local financial and intellectual resources. However, they themselves pose a significant policy challenge. Decision-makers at various levels and in all sorts of organisations – politicians, policy-makers, employees of executive agencies and applicants (research organisations, firms, especially SMEs) – have to learn how to use them effectively. They can learn from EU officials, advisors, each other as well as their opposite numbers in other countries in various ways: attending meetings, formal training courses, info days, etc. A major question is how fast this learning can be, and what impacts the EU funds and policies have on agenda setting, policy discussions and co-ordination, funding decisions at national and regional level.

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Cohesion can only be achieved if it is supported by technological and organisational innovations, together with behavioural changes in catching up regions and countries. Thus, STI policies are of crucial importance for CE policy-makers when they are trying to formulate adequate responses to the above challenges. Without devising and implementing sound policies to foster both knowledge creation and exploitation (diffusion) of knowledge, these countries would continue lagging behind the advanced EU members, moreover, the current development gap is likely to widen and deepen. The following sections, therefore, turn first to the Hungarian STI policy community, and then to the policy schemes. In other words, from this point on the analysis is going to be focused on the Hungarian case.

3 THE STI POLICY COMMUNITY IN HUNGARY: ROLES AND RESPONSIBILITIES OF VARIOUS ORGANISATIONS

The main government bodies responsible for STI policies were constantly reorganised throughout the 1990s in Hungary. It would require a separate, rather lengthy paper to describe these changes in detail, and discuss the revealed or hidden political and policy rationales behind them. This section, however, is only aimed at providing a brief overview of the current organisational set-up as a background to better understand the recent policy schemes, to be depicted in the following section.

The *Education and Science Committee* of the Parliament is the highest-level political decision-making body in the field of science and innovation policy in Hungary.

Science and Technology Policy Council (TTPK) and its Advisory Board (TTTT)

TTPK is the highest-level consulting and co-ordination body in the field of STI policy in the government, since 2002 headed again by the Prime Minister. Its two Vice Chairs are the Education Minister and the President of the Hungarian Academy of Sciences. TTPK assists the government in making decisions on STI policy issues and in the preparation of strategic decisions. TTTT is an expert committee of TTPK, consisted of researchers active in various fields of sciences and engineering.

Ministry of Education (OM)

The Ministry of Education plays a key role in devising and implementing science and education policies. OM supervises the whole state education system from elementary schools to universities, except the defence and police education organisations, thus it has full responsibility in providing human resources for the economy.

National Office of Research and Technology (NKTH, Nemzeti Kutatási és Technológiai Hivatal)

The fate of its predecessor, OMFB (Országos Műszaki Fejlesztési Bizottság - National Committee for Technological Development) says volumes about the political status of STI policies in Hungary. It used to be headed by a deputy prime minister until 1990, 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 OMFB itself was 'relegated' from being a government agency to a division of the Ministry of Education. These changes strongly suggest that innovation has not been on the top of the agenda of any government since 1990.

The most worrying consequence of the 2000 reorganisation was a fundamental change in the decision-making system. Until the end of 1999, strategic issues were decided upon 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 STI 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. In

January 2000, however, the former OMFB Council became an advisory board for the Minister of Education, i.e. lose its decision-making power.

There was a change in government in 2002, and then it took another one and a half years to re-establish the previous organisational status of this government agency, renamed as National Office of Research and Technology. In the period of January 2000 – December 2003, however, the organisational culture has substantially deteriorated, and thus it would be quite a challenge just to achieve again what had been the 'normal' level of operations in the late 1990s. One should not forget, though, that NKTH was already a 'relegated' compared to the political status enjoyed by OMFB in the beginning of the 1990s.

NKTH is the major government agency in the field of STI policy. It is responsible for the government's technology policy, it devises R&D and innovation programmes, manages international R&D co-operation in bilateral and multilateral relations as well as supervises the network of Hungarian science and technology attachés.

Further ministries

All ministries have some role in shaping RTDI activities in their own field, financing R&D institutes, research and innovation programmes, or education and training projects. The Ministry of Economic Affairs supervises the government offices responsible for quality management, intellectual property, standardisation, metrology, energy, and consumer protection. Other ministries (FVM – Ministry of Agriculture and Rural Development, KVM – Ministry of Environment Protection and Water Management, GKM – Ministry of Economic Affairs and Transport, ESzCsM – Ministry of Health, Social and Family Affairs) also carry out considerable R&D and innovation tasks. Some ministries supervise their own research institutes.

Hungarian Academy of Sciences (MTA)

As stipulated by the Law XL 1994, the Hungarian Academy of Sciences is a legal entity, a public body having self-governing rights. It has a high degree of independence in scientific, political and financial respects. Its task is to develop, promote and represent science. MTA gives its expert opinion to the Parliament or the Government upon request. MTA supervises the ethical norms in science and publishes scientific journals. MTA has the right to establish and operate research institutes, libraries, archives, information services, etc. In 2002 – having merged several smaller institutes – MTA had 37 research institutes.

The General Assembly of MTA elects the president, the vice-presidents, the secretary general, and further delegates. The president of MTA, being elected for five years, has to report to the Government every year and to the Parliament every other year on the activities of MTA and on the general conditions of science in Hungary.

National Scientific Research Programmes (OTKA)

MTA supervises OTKA (National Scientific Research Programmes) that supports basic research projects, young researchers' projects and R&D infrastructure development through competitive funding schemes. OTKA was established in 1991. (for further details, see: www.otka.hu)

Higher Education Development Programmes (FEFA)

FEFA used to be the "Fund for Catching up with the European Higher Education" since 1991 as an independent financial fund, allocating mainly international loans. It was reorganised in 1996 with a new name, but with the same acronym (in Hungarian). Now it promotes the development of new higher education curricula and infrastructure, especially hardware, software and network investments. The Ministry of Education supervises the activities of FEFA.

4 AN OVERVIEW OF SCIENCE, TECHNOLOGY AND INNOVATION POLICY SCHEMES

Reflecting the recent policy approaches in evolutionary economics of innovation, Dodgson and Bessant (1996) 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' (p. 4). 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 (pp. 4-5). These definitions are applied in the remaining sections of the paper.

4.1 Science policy schemes

As for science policy, it is implemented through the annual government grants to the Hungarian Academy of Sciences (HAS) and its subsequent allocation among the HAS institutes and the National Scientific Research Fund (OTKA). Young Hungarian scientists can also apply for government-funded grants to finance their research activities in Hungary for a three-year period.[7] The Higher Education Development Programmes (FEFA) can also be regarded as an indirect science policy tool. Further, five "national R&D programmes" (NKFP) were launched in 2000 by the Ministry of Education to finance big projects 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.[8]

As Figure 1 clearly shows, science policy schemes (that is, NKFP and OTKA) have been financed more generously than technology policy ones (KMÜFA, Central Technological Development Fund).

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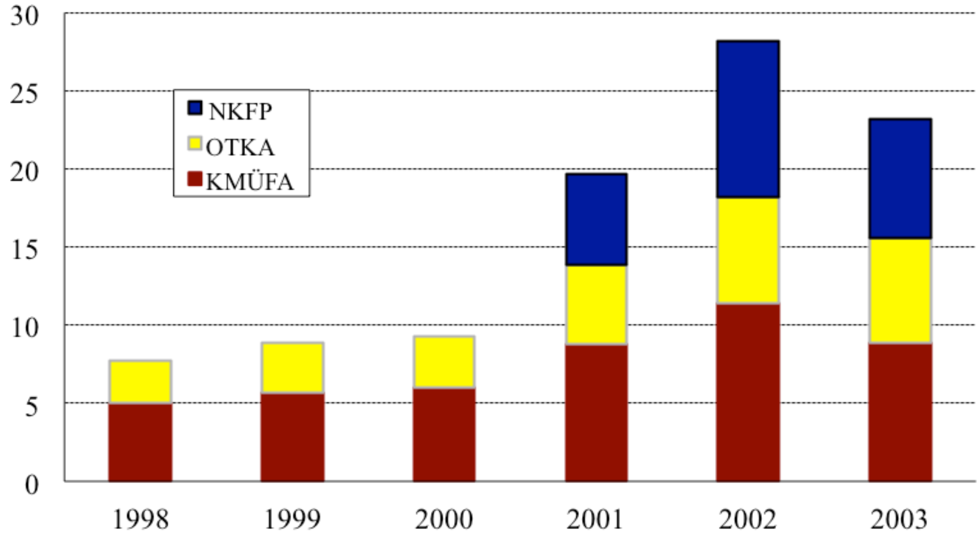
[7] The goal of this scheme, called Bolyai grant is obviously to curb brain-drain.

[8] Funding through this new scheme started in 2001, and is administered by a newly established Programme Office.

Figure 1: Funds earmarked for science and technology policy schemes, 1998-2003 (billion HUF, current prices)



Source: National Office of Research and Technology

4.2 Technology and innovation policy schemes up until 2003

Technology policy schemes used to be devised and administered by the OMFB until 1999. Schemes were revised annually, and approved by the OMFB Council, together with the funds earmarked for them. In the period of January 2000 – December 2003, when the former OMFB operated as the R&D Division of the Ministry of Education, the Minister took 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, such as:

- information and communication technologies;
- biotechnology; and
- environmental technologies.[9]

Other 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.

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

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'

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[9] Some of these tools were not available in every single year up until 2002, due to financial constraints. 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).

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 improving the conditions for R&D and innovation activities, and hence it would be difficult 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 1, reveal.

Table 1: Further schemes funded by the Central Technological Development Fund (1999-2002)

Scheme	Objective
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 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 official documents launching the various CTDF schemes

The R&D Division of the Ministry of Education launched 9 schemes in 2003, among which there were 4 new ones. Table 2 summarises all these schemes, just to give a quick overview of the current schemes. The new ones are italicised. It should be added, however, that due to lack of funds, these schemes – except the ones aimed at promoting Hungarian participation in EU RTD FP6 projects, namely EUB, EUK and EUI, plus MEC – were only launched in September 2003, and no funding decision has been taken until February 2004. As already mentioned, the R&D Division of the Ministry of Education was reorganised yet again, with effect from 1 January 2004, which might have slowed down the assessment of project proposals. Moreover, the structure of STI policy schemes has had to be revised due to the EU-membership, and that might have caused further delay in funding decisions. (see Section 4.3)

Table 2: Technology and innovation policy schemes launched in 2003

Scheme	Objectives of scheme	Eligible activities/ cost elements/ conditions
Technology-intensive micro firms (TST) [modified]	Commercialisation of innovative ideas and R&D results by supporting start-up and spin-off firms	Feasibility studies for innovation projects; up to 2 m HUF Improving upon own R&D results; up to 10 m HUF Adaptation of purchased R&D results; up to 10 m HUF Setting up spin-off companies; up to 2 m HUF Patent and trademark application fees
Improving human resources for R&D and innovation (EE)	Creation of new R&D jobs, especially at SMEs 'Sabbatical' of R&D staff employed by SMEs (at universities and other public R&D institutes)	Labour costs in the case of newly created jobs up to 2 years, max 200,000 HUF per month Investment costs needed to create R&D jobs, 60% of total costs, up to 2 m HUF Labour costs of 'sabbatical' (6 months – 3 years), max 200,000 HUF per month, per capita + 800,000 HUF for consumables every 6 months, per capita
Upgrading the physical infrastructure of business R&D units (CSI)	Creating new R&D jobs, improving working conditions for researchers	Purchasing R&D instruments and equipment, hardware, software, books, journals (hard copies or electronic versions), 7 m HUF per jobs, min 21 m HUF, max 210 m HUF; 25% of investment costs incurred by the firm Co-operation with domestic R&D institutes is preferred R&D jobs to be kept for at least 5 years
Thematic R&D Programme (applied R&D projects, up to 30% basic research element) [modified]	Fostering the development of new products, services and processes	Fields of research: • material sciences and nanotechnology (4 fields) • manufacturing technologies (4 fields) • biotechnology (6 fields) • electronics, measurement, control technologies (2 fields) • energy technologies (5 fields) • information and communication technologies (2 fields) • environmental technologies (5 fields) • transport technologies, logistics (5 fields) 5-75 m HUF per projects; equipment and instruments up to 30% Features of preferred projects: • academia-industry co-operation • exploitation of results in the higher education • co-operation with neighbouring countries • other international co-operation (EU, NATO projects)
Upgrading the physical infrastructure of R&D institutes (KMA) modified]	Modernisation of equipment to improve international competitiveness	Purchasing new R&D instruments and equipment, upgrading existing ones Accreditation of laboratories Loan of R&D instruments and equipment Purchasing measurement services 3.5 – 50 m HUF; up to 70% of investment costs incurred by the institute up to 5 m HUF for upgrading instruments up to 5 m HUF for accreditation costs up to 5 m HUF for measurement services
Joining EU RTD FP6 projects (EUB) modified]	Assisting Hungarian participation in EU RTD FP6	Attending project preparation meetings abroad Organising project preparation meetings in Hungary Purchasing relevant legal, financial, project management services Purchasing relevant consumables Travel costs and purchasing services once the project is approved, in the contract negotiation phase 0.5 – 1 m HUF

Scheme	Objectives of scheme	Eligible activities/ cost elements/ conditions
Project preparation grant for SMEs joining EU RTD FP6 projects (EUK)	Assisting Hungarian SMEs' participation in the EU RTD FP6	Feasibility studies; up to 50% of costs, max 2 m HUF Market research relevant for the project proposal; up to 50% of costs, max 2 m HUF Patent research to establish novelty; up to 100% of costs, max 2 m HUF
Information and consultancy services related to EU RTD FP6 projects (EUI)	Assisting regional, non-profit information and consultancy services related to EU RTD FP6 projects	Complex information and consultancy services, for 1-2 years; max 75% of costs, up to 10 m HUF for 2 years Occasional information and consultancy services; 100% of costs, up to 2 m HUF per year
'Maecenas' Programme (MEC)	Supporting participation at, or organisation of, conferences Paying membership fees in international S&T organisations Popularisation of S&T	0.3 – 6 m HUF

Source: author's compilation from official documents launching the various CTDF schemes

4.3 New technology and innovation policy schemes since 2004

Joining the EU has major repercussions in relation to STI policy schemes. EU rules on public subsidies have to be followed. One of them is that schemes cannot be "doubled": a given objective/ activity can only be supported by one scheme, either by a purely national one, or by a jointly financed one. Therefore, the ones eligible for co-funding from the European Regional Development Fund (ERDF) have to be clearly separated from the ones supported by purely national sources. It also means, however, that significant additional funds have become available since 1 May 2004.

The revised former schemes and the new ones now are grouped into two sets, following the logic explained above. They are presented here in this structure.

4.3.1 STI policy schemes in the Economic Competitiveness Operational Programme

A large number of the former OMFB schemes had rather direct impacts on competitiveness, and thus those are now part of the Community Support Framework,[10] under the heading of Economic Competitiveness Operational Programme (ECOP), Priority 3, Research, Development and Innovation. The budget of this priority is 35 billion HUF for the period of 2004-2006, of which 25 billion would be financed by the ERDF. These schemes have been devised by the Office of Research and Technology, but their so-called Managing Authority is the Ministry of Economic Affairs and Transport. (A quick look at Tables 2 and 3 reveals that the ECOP STI policy schemes are modified versions of the technology and innovation policy schemes launched by the R&D Division of the Ministry of Education in September 2003.)

[10] The Community Support Framework (CSF) is the legal form of the actual financial commitment of the EU and the Hungarian Government to finance those objectives/ activities, which they have jointly approved when discussing the National Development Plan and the Operational Programmes, prepared by the Hungarian government for the period of 2004-2006. (It is also called as a Single Programming Document.)

Table 3: Technology and innovation policy schemes in the ECOP, launched in January 2004

Scheme	Objectives of scheme	Eligible activities/ cost elements/ conditions
Application-oriented research and technology development (AKF) (basic research elements are eligible up to 30%)	Fostering the development of new products, services, materials and processes	Fields of research: • material sciences, nanotechnology and manufacturing technologies • biotechnology • electronics, measurement, control technologies • energy technologies • information and communication technologies • environmental technologies • transport technologies, logistics Total budget: 7000 m HUF Expected number of projects to be supported: 140 Form of assistance: non-refundable subsidy 10-100 m HUF per projects; equipment and instruments up to 30% Features of preferred projects: • link with EU RTD FP projects • other international co-operation • participation of SMEs
Upgrading the physical infrastructure of publicly financed and non-profit R&D institutes (KMA)	Modernisation of equipment so as to improve efficiency of R&D activities	Purchasing new R&D instruments and equipment, upgrading existing ones Accreditation of measurement activities Total budget: 3000 m HUF Expected number of projects to be supported: 100 Form of assistance: non-refundable subsidy 10 – 100 m HUF for purchasing new R&D instruments and equipment, up to 90% of investment costs incurred by the institute 1 – 10 m HUF for upgrading instruments 1 – 5 m HUF for accreditation costs
Co-operative Research Centres (KKK)	Integration of higher education, R&D, knowledge and technology transfer activities by establishing CRCs, jointly set up by higher education institutes, R&D institutes and businesses at least for 3 years, preferably 6-9 years	Multi- and trans-disciplinary, oriented basic and applied research projects, aimed at problem-solving Scientific training of students, lecturers and researchers Adaptation, improving upon R&D results Feasibility studies for innovation projects Purchasing R&D services Obtaining licences, know-how Patent and trademark application fees Purchasing legal, IPR, financial, management consultancy services Total budget: 3000 m HUF Expected number of projects to be supported: 10 Form of assistance: non-refundable subsidy 60 – 400 m HUF for 3 years, up to 50% of the total budget of the project, of which up to 40% for R&D equipment At least 5 business partners, and 10 PhD students or young researchers are required

Scheme	Objectives of scheme	Eligible activities/ cost elements/ conditions
Technology- and knowledge intensive start-up micro firms and spin-off companies	Commercialisation of innovative ideas and R&D results by supporting start-up and spin-off firms	R&D projects Adaptation, improving upon R&D results Feasibility studies for innovation projects Purchasing R&D services Obtaining licences, know-how Patent and trademark application fees Purchasing legal, IPR, financial, management consultancy services Total budget: 800 m HUF Expected number of projects to be supported: 40 Form of assistance: non-refundable subsidy So-called *de minimis* subsidy, up to 100,000 euros (in HUF) for 3 years, of which up to 40% for R&D equipment
Development of the physical infrastructure of business R&D units	Creating new R&D jobs, improving working conditions for researchers, and thus enhancing competitiveness	Purchasing R&D instruments and equipment, hardware, software for newly created jobs At least 3 jobs per projects, 10 m HUF per jobs Total budget: 800 m HUF Expected number of projects to be supported: 15 Form of assistance: non-refundable subsidy 45% of investment costs incurred by SMEs, 25% for other firms Newly created R&D jobs to be kept for at least 5 years
Promotion of innovation at SMEs	Developing innovation capabilities of SMEs, fostering academia-industry co-operation aimed at introducing new or improved products, services, processes	Obtaining exploitation rights of R&D results Commissioning applied R&D activities Own R&D projects Improving upon existing technologies, products, services Feasibility studies for innovation projects Total budget: 400 m HUF Expected number of projects to be supported: 20 Form of assistance: non-refundable subsidy Up to 50 m HUF, 45% of total R&D costs, 50% of feasibility studies

Source: author's compilation from official documents launching the various ECOP schemes

4.3.2 STI policy schemes run by the Office of Research and Technology

In parallel with the reorganisation of the government body responsible for STI policies, on 10 November 2003 a new legislation was passed on a new fund to finance RTDI activities, called Research and Technological Innovation Fund (Law XC 20003). It is replacing the former Central Technological Development Fund, which used to be financed directly from the state budget since the early 1990s. RTIF is financed from two sources: companies pay a levy – depending on their size, it varies between 0.1–0.2% of revenues –, while the central budget should double the contribution from the business sector.

The planned new STI policy schemes are to be financed by RTIF. The priorities for 2004 are as follows:

- enhancing the competitiveness of the Hungarian economy by direct and indirect support to innovation at firm level, as well as by boosting demand for innovation
- promoting industry-academia co-operation
- fostering regional innovation

- orchestration with the schemes financed by the Community Support Framework (ECOP)
- harmonisation with EU RTD FP6 programmes, especially calls for Networks of Excellence and Integrated Projects
- building intense, wide-ranging science – society relationships, popularisation of science and technology.

5 POLICY HYPES AND MISCONCEPTIONS

Innovation theory has over the past few decades developed a complex, and thus realistic picture of innovation as a multi-faceted process, realising the importance of many sources and types of knowledge, and that of the linkages and co-operation among the diverse players. (Dosi, 1988; Dosi *et al.* (eds) 1988; Dosi *et al.*, 1994; Dodgson and Rothwell (eds), 1994; Edquist (ed.) 1997; Freeman, 1994; Lundvall and Borrás, 1999; OECD, 1992; Smith, 2002)

Efficient public policies should be built on a sound conceptual basis, otherwise taxpayers' money is likely to be spent on wrong objectives: supporting what need not or should not be supported, and leaving without assistance those activities/ objectives, which should have been subsidised. This section, therefore, offers a brief critique some of the most dangerous policy hypes and misconceptions.

5.1 Knowledge-based economy and high-tech industries

Recently one of the most widely used phrases is the knowledge-based economy or society. It is a commonplace, however, that *all* economies are based on knowledge, starting from gathering and hunting as the main economic activities of the first human beings, followed by the more advanced agriculture in ancient Egypt and Mesopotamia. Thus other terms seem to be more appropriate, namely 'knowledge-driven' or 'learning' economies, if one is to emphasise the changing nature and dynamics of modern economies, and the vital role, which knowledge and learning – more importantly learning capabilities – play in defining competitiveness.

A closely related, and highly 'admired', term is high-tech. A closer look at success cases, i.e. the reality of innovation processes clearly shows, however, that "(…) knowledge drivennes is not restricted to a few glamorous industries, but applies to all (…) industries, high or low tech." (EC, 2000, p. 2) Summarising the results of recent empirical analyses on output and growth, Hirsch-Kreinsen *et al.* (2003, p. 6) also point out the importance of non-high tech industries: "The empirical evidence is strong and the facts are surprising. Between 90 and 97 per cent of GDP in EU countries is accounted for by activities, which are classified as non-high tech according to OECD classification routines. (…) Even before the recent industrial downturn led by the ICT industry (classified of course as high tech), many of the fastest growing sectors in the economy were in fact neither R&D intensive nor particularly science-based. In international trade, most of the advanced economies are specialized in LMT [low- and medium-tech] industries, and this specialization does not affect their growth performance. Such sectors generate significant quantities of innovation output, in the sense of sales of new and technologically changed products, and invest significant resources in innovation." (references to be found in the original text)

5.2 Intra-sectoral R&D vs. knowledge-intensity and the limits of technology classification

The main source of a potential policy mistake stemming from the 'high-tech hype' is a simple methodological (measurement) problem. What is defined as a knowledge-intensive industry (or service) by the OECD – cf. OECD [2001], pp. 124, 137–140; OECD [2003], pp. 140, 155–157 – is not necessarily a knowledge-intensive industry (or service) in all countries. Indeed, the technology classification in the 2001 edition of STI Scoreboard is based on an evaluation of R&D intensities for 13 OECD countries for the period 1991–97.[11] Srholec (forthcoming, Figure 4) clearly shows that the actual R&D intensities of the so-called ICT high-tech industries (30, 32 and 33 as defined by ISIC, rev. 3) were well below the OECD high-tech threshold in 1995–2000 in a large number of OECD countries, including not only all the four Central European member states, but Denmark, Italy, Korea, Mexico, Portugal and Spain as well.

A further problem is that both the 2001 and 2003 editions of the OECD STI Scoreboard – as well other OECD documents – equate knowledge-intensity with R&D intensity. It is rather surprising because the Oslo Manual on innovation – also published by the OECD – calls attention to many forms and sources of knowledge (other than formal, intra-sectorial R&D). Moreover, it also disregards a huge body of literature clearly showing the importance of distributed knowledge bases (or knowledge infrastructures), sectoral and national innovation systems, innovative networks and clusters, to which, ironically, the OECD's own contribution is not negligible, either. (Breschi and Malerba, 1997; Dodgson and Rothwell (eds), 1994; Freeman, 1991, 1994; Freeman and Soete, 1997; Lundvall and Borrás, 1999; Malerba, 2002; Nelson (ed.) 1993; OECD, 2000 ch. 7, 2001b, 2002 ch. 4; Smith, 1997, 2002; Tidd *et al.* (eds), 1997 ch. 7-8)

This mistake is reinforced – and thus it is even more worrying – by the way in which the OECD has defined and used the term 'investment in knowledge': "Investment in knowledge is defined and calculated as the sum of expenditure on R&D, on total higher education from both public and private sources and on software." (OECD, 2003, p. 16; the term is used in the same way e.g. in OECD 2001a, 2002) In light of the literature on economic exploitation of knowledge, it is a highly questionable definition. In 'small prints', the OECD admits, though: "A more complete picture of investment in knowledge would also include parts of expenditure on innovation (expenditure on the design of new goods), expenditure by enterprises on job-related training programmes, investment in organisation (spending on organisational change, etc.), among others. However, owing to the lack of available data, such elements could not be included." (OECD, 2003, p. 16) The snag is that busy politicians and civil servants tend to focus on country rankings and the highlights of the OECD reports, based on this mistaken definition – and printed in 'normal' characters –, and are likely to ignore long, complicated methodological explanations, presented in boxes and printed in smaller fonts. Thus, they are misled by figures, tables and statement based on simplified – and admittedly inappropriate – definitions and measurement.

5.3 A caveat on activities, products, firms and sectors

An important policy lesson can be drawn from the above discussion: when devising policies to promote innovation and hence competitiveness, one should bear in mind that there is no one-to-one relationship between sectors, firms, products, and activities even in the same country, i.e. knowing just one these 'variables' the major qualities of the others cannot be

[11] The 2003 edition covers a slightly longer period, namely 1991–1999 , although for only 12 OECD countries.

'deducted'. Firms belonging to the same statistical sector might well possess quite different capabilities – e.g. innovation, production, management, marketing and financial ones –; they are unlikely to produce identical goods – e.g. in terms of skills and investment requirement, quality, market and profit opportunities –; and they perform different activities, especially in terms of their knowledge-intensity. These dissimilarities are likely to be even more pronounced when talking about sectors, firms, products and activities across different national systems of innovation and production. In short, the performance of heterogeneous firms cannot be improved by uniform policy approaches. No doubts, it sounds elementary; yet policy-makers tend to prefer 'broad', general schemes, and thus they are less willing to pay attention to these details, and even less ready to devise and operate differentiated schemes, taking into account this very simple fact of life.

6 Conclusions

This paper, relying on the conceptual framework of evolutionary economics of innovation, has discussed the recent Hungarian STI policy measures in the broader context of economic development, and the specific transition, accession and cohesion challenges in particular, which Central European countries are faced with. Policy-makers, therefore, have to work in a very demanding overall context.

By criticising various policy misconceptions and hypes, the chapter has argued that policy-makers should understand the non-linear, complex relationships between (domestic) R&D efforts, innovation, competitiveness, and thus cohesion with the more advanced members of the EU. They then can define appropriate goals for their countries in a broad innovation system framework, understanding the importance not only of knowledge creation, but also that of the exploitation of knowledge, i.e. diffusion of all sort of innovations (technological, organisational, managerial, marketing and finance). In other words, they should focus on fostering knowledge-intensive activities across all sectors and among as many firms as possible, as opposed to focusing on achieving an 'optimal' macroeconomic structure. It is strongly recommended, therefore, to avoid the trap of nurturing 'over weighted' (export-oriented) high-tech sectors at any rate, i.e. those characterised with rather low level of local value-added, just because the share of these sectors is a commonly (mis)used benchmark.

It should be stressed, however, that the paper has not intended to question the importance of R&D *per se*. Rather, one of the objectives of the above critique is to urge policy-makers asking fundamental questions: what sort of R&D should be promoted, for what purposes, in what context. They should also bear in mind that both 'faces' of R&D are crucial: not just the one, 'which' creates new knowledge, new technologies, but the other one, too, 'which' helps making informed decisions on what to import, how to adapt the purchased technologies and disembodied knowledge (know-how, licences) to local conditions, and how to improve upon them.

Hungarian policy-makers in charge of STI policies have apparently avoided the 'magnetic power' of the high-tech trap. They have put in place a broad range of policy instruments, aimed at promoting both creation and commercialisation of technical knowledge, instead of an excessive emphasis on some 'fashionable' high-tech fields. Some of the new schemes have been devised in a close co-operation with, or even at the initiative of, the business community, e.g. the "Integrator" scheme introduced in 1999.

It should be stressed, however, that a promising policy learning process was drastically stopped when the former OMFB, the government agency responsible for technology policy schemes was 'relegated' from a semi-independent agency to a Division of the Ministry of

Education. An old way of thinking was then not just re-introduced, but literally reinforced, putting more emphasis on, and concomitantly more public money into, newly devised, basic research type of projects, with not much thought on innovation and the broader socio-economic development in mind. In short, four years – and a non-negligible amount of public money – were lost.

Sadly, it has happened in a period of daunting challenges, when a drastic restructuring of the national innovation system is indispensable: learning and 'unlearning' are inescapable in various segments both in the private and public sectors and at all levels (policy-making, research organisations, firms, individuals). In sum, a sort of 'planned, policy-assisted creative destruction' is needed. Like in most other CECs, the Hungarian innovation policy constituency should be strengthened and better organised, stakeholders need to be more closely, and systematically involved in preparing strategic decisions. Important policy-preparation methods should also be introduced, such as the evaluation of public policy schemes. That is the only way to obtain a reliable picture on the socio-economic impacts of the various schemes, which is badly needed for being able to improve upon the current policy tools. Moreover, communication and co-ordination among the ministries responsible for various elements of STI policies should also be developed considerably, in order to enhance the efficiency and efficacy of public spending.

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