ERAWATCH COUNTRY REPORTS 2012: HUNGARY

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The Country Report 2012 builds on and updates the 2011 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges**,** highlighting the latest developments, their dynamics and impact in the overall national context.

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The report is currently only published in electronic format and is available on the ERAWATCH website. Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

EXECUTIVE SUMMARY

Hungary, with its population of 9.99 million (2% of the EU-27 total) is a medium-sized EU member state. The Hungarian GERD was fluctuating between 0.9-1.17% of the GDP in the past decade (2001-2010) then reached its highest ratio in 2011 (1.21%). With these efforts, Hungary still devotes significantly fewer resources to R&D than the EU-27 average: the GERD/GDP ratio was 59.6% of the EU-27 average in 2011.

The business expenditures on research and development constitute the biggest share of the total, up from 39.5% in 2005 to 47.5% in 2011, although stayed almost the same compared to 2010 (47.4%). Public funding decreased from 49.6% in 2005 to 38.1% in 2011, (down from 39.3% in 2010). Research and development funding from abroad has a quite high and slightly increasing share of the GERD (10.7% in 2005 and 13.4% in 2011). Since 2005, the share of FTE researchers in total employment increased from 0.41% to 0.6% in 2011, while the share of all FTE R&D employees did so from 0.6% to 0.89% in the same period. As for scientific output, the number of books and book chapters by Hungarian researchers grew by 9.6% in 2011 (the ones published in Hungarian by 6%, while that of published in foreign languages by 19.3%).

Businesses have maintained their position as the largest employer of (FTE) researchers since 2006, reaching 50.7% in 2011, and had the biggest share in performing GERD (62.4%), too. The government sector's share was 24.9% in 2011 in the total number of (FTE) researchers. This figure reflects a high weight of PROs in the Hungarian innovation system compared to the EU-27 average (12.5% in 2010). The most important player is the Hungarian Academy of Sciences (MTA) with still a substantial – albeit declining – weight in the Hungarian research system: its share was 12.8% in the total R&D personnel (FTE) and 10.2% of the GERD in 2011.

The draft National Research-development and Innovation Strategy (entitled "Investment in the Future"), published for public consultation in early November 2012, to be approved by government decision in early 2013 set the target with reference to the National Reform Programme: "Hungary will increase its research and development expenditures to 1.8% of the GDP by 2020 and 3% by 2030". A complementary target of the strategy is that BERD will reach 1.3% of the GDP by 2020.

Hungary has all the major elements of a potentially successful national innovation system (NIS). The highest-level political body in the field of STI policy, the National Research, Innovation and Science Policy Council (NKITT) had been set up in December 2010 to co-ordinate governmental STI policy decisions. NKITT was dissolved on 2 July 2012 when a new body, called National Development Cabinet (NFK) was set up chaired by the prime minister. Its members are the secretary of state heading the Prime Minister's Office, the ministers responsible for the national economy, and national development, respectively. The National Innovation Office (NIH) is responsible for the government's technology and innovation policy. Funds allocated through the Operational Programmes of the New Hungary Development Plan (2007-13) are managed by the National Development Agency (NFU).

Apart from the provision of institutional – core – funding for research and development activities conducted in the higher education sector and by PROs', project based funding is a major mechanism for public support to RTDI activities. The two most important financial sources providing competitive funding for R&D activities are the Research and Technological Innovation Fund (RTIF), and the various Operational Programmes of the New Hungary Development Plan co-financed by the EU Structural Funds. The budget law for 2011 did not allow to make new commitments to finance RTDI projects from the RTIF, that is, new calls of the on-going STI policy support schemes was not launched, let alone new schemes. Only

financial commitments made earlier e.g. in connection to international co-operation and on-going R&D projects could be fulfilled. From January 2012 on, two fundamental rules, governing the RTIF, have been changed: no contribution is to be paid from the central budget in 2012 and firms cannot deduct any longer either their intramural R&D expenditures, or the amount they spend on commissioning publicly financed R&D units from the innovation levy. After two years of suspension, new programme calls of the KTIA were launched in 2012.

The regional level governance became weaker after the dissolution of the Regional Development Councils in effect from January 2012. Apart from, and partly in connection, to this decision, the future of important regional intermediaries, such as the Regional Innovation Agencies became uncertain. The preparation of the regional smart specialization strategies (RIS3) has started early 2013. The Ministry for National Economy requested the National Innovation Office to coordinate the production of those strategies and carry out the societal consultation process. The RIS3 strategies are produced by the regional innovation agencies and will be completed in April 2013.

The overall paradoxical feature of the Hungarian NIS is that innovation performance is 'moderate' in spite of an impressive number and range of STI policy measures. The five major structural challenges of the Hungarian national innovation system are fairly similar to those of the previous year as the situation and framework conditions for RTDI have not changed significantly.

1) *Low level of innovation activities, especially that of the SMEs.* Only about one-fifth of enterprises introduce product or process innovations in Hungary, with no major change since 2002. This ratio is even lower for SMEs.

2) *Low occurrence of co-operation in innovation activities among key actors.* The frequency of innovation co-operation reported by Hungarian firms is higher than in most EU countries, yet, only 6.5% of innovative firms reported any form of co-operation with Hungarian "government or public research institutes".

3) *Insufficient quantity and supplement of human resources for R&D and innovation.* The share of S&E graduates and the rate of participation in life-long learning are rather low in international comparison. A significant gap might be opening between the supply and demand for qualified science and engineering (S&E) personnel in the near future.

4) *Unfavourable framework conditions for innovation.* The macroeconomic situation, the structure of the economy, the overall entrepreneurship culture together with the intensity and type of competition seem to influence firms' behaviour with such a power that STI policy schemes cannot offer strong enough incentives to overrule these unfavourable effects.

5) *Deficiencies in the STI governance system and the institutional framework.* There was another wave of reorganisation of major STI policy-making bodies and the RTDI funding structure introduced by the new government since 2010. The draft innovation strategy (published in November 2012) also reflects some uncertainties concerning the implementation structures of the strategy.

Priorities of research and innovation strategies in the past few years and the recently launched draft national innovation strategy takes into account the above shortcomings, although set ambitious targets in terms of quantitative measures. With a view of the evolution of the national innovation system, no 'quick fix' of the STI governance system and institutional framework seems possible.

Based on the analysis of Hungarian NIS and its identified structural challenges, promising development directions of the policy mix, on short and medium term, could be the following:

- streamlining the number of RTDI policy measures and their administrative burden as well as definition of RTDI-related calls, guidelines in a way to generate more interest from SMEs for participation and joint RTDI activities with academia;
- attraction of young and mid-carrier professionals from companies to PROs and universities to introduce professional research management techniques, develop collaborations with companies and foreign R&D institutes as well as enhance the exploitability of research results;
- setting clear performance measures for research personnel at public universities and PROs for increasing the overall quality of scientific outcomes, carry out research relevant for addressing societal challenges and avoid the replication of already existing research results;
- implementation of measures that support the specialisation of intermediary organisations (e.g. regional innovation agencies, technology transfer offices), helping them to achieve critical mass both in their size and responsibilities as well as ensure their long term funding for the sake of creation of stability for their operation;
- application of modern, participatory policy preparation tools (e.g. foresight) for designing RTDI concepts, sectoral strategies, as well as carry out systematic evaluation of programmes and measures to better prepare future policies.

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1 INTRODUCTION

Hungary, with its population of 9.99 million (2% of the EU-27 total) is a medium-sized EU member state. Its GDP was 0.7% of the EU-27 total in 2011. As for economic development, measured by GDP per capita (in PPS), the country ranked 22-23rd with Lithuania in the EU-27 in 2011, with 66% of the EU-27 average. After having a -6.8% decrease of its GDP per capita in 2009, the recovery was slower in 2010 (1.3% vs. 2.1%), almost the same in 2011 (1.6% vs. 1.5%) in comparison with the EU-27 average. The Eurostat forecasts -1.2% shrinking for 2012 (vs. -0.3% for EU-27) then similar growth prospects for 2013 and 2014 (0.3% and 1.3%) compared with the EU 27 average (0.4% and 1.6% respectively).

The Hungarian GERD was fluctuating between 0.9-1.17% of the GDP in the past decade (2001-2010) then reached its highest volume in 2011 (1.21%). With these efforts, Hungary still devotes significantly fewer resources to R&D than the EU-27 average: the GERD/GDP ratio was 59.6% of the EU-27 average in 2011.

Since 2005, the share of FTE researchers in total employment increased from 0.41% to 0.6% in 2011, while the share of all FTE R&D employees did so from 0.6% to 0.89% in the same period. Apart from increasing employment of researchers in the workforce, the share of R&D investments grown from 0.7% to 0.9% in total investments between 2005 and 2011. As for scientific output, the number of books and book chapters by Hungarian researchers grew by 9.6% in 2011 (the ones published in Hungarian by 6%, while that of published in foreign languages grew by 19.3%). The total number of articles increased by 0.8%, but that of published in foreign languages increased by 0.4%. There are significant differences by sectors: higher educational staff members are the most productive (on average 120 books and book chapters as well as 346 articles by 100 FTE researchers), followed by researchers employed in the governmental sector (60 books and book chapters as well as 138 articles by 100 FTE researchers), and researchers working for businesses (2 books and book chapters as well as 12 articles by 100 FTE researchers). (KSH, 2012, Table 24)

Most books, book chapters and articles in Hungarian language are published by social scientists and researchers working in the field of humanities (57.5%) followed by technical, natural and medical scientists (12.0%, 11.8% and 11.7% respectively). Different pattern can be observed concerning books, book chapters and articles published in foreign languages. In this respect, natural scientists have a clear lead with 40.5% of total, followed by medical scientists (26.0%). (KSH, 2012, Table 25) In international comparison Hungarian scientific output, ranked 35 in terms of publications recorded in Scopus in 1996-2007, and 24 in terms of citations in the same period. Researchers working in physics and astronomy; pharmacology, toxicology and pharmaceutics; earth and planetary sciences; and chemical engineering outperformed the Hungarian average both in terms of share of Hungarian publications in relation to total publications, and the number of citations relative to the world average of citations in a given research field. (Schubert, 2009)

The number of patent applications increased by 2% in 2011 compared to the previous year. In total, 660 domestic patents were filed at the Hungarian Patent Office. The number of domestic trademark applications grown by 8.5%, a total of 3,772, the highest figure since 2004. Hungarian applicants' IP activity abroad, contrary to the domestic trend, shows a slight decrease. There is one exception, the WIPO international trademark applications increased by 40%. The patent applications filed abroad by Hungarian applicants decreased by 17% (142) in case of applications filed under the Patent Cooperation Treaty (PCT). The applications for European patents decreased by 12% (168) in one year, due to the economic recession and the stop of R&D tenders. (HIPO, 2012, p.14)

With regard to Innovation Union Scoreboard 2011 indicators, Hungary is one of the moderate innovators with a below average performance. Relative strengths are in human resources and economic effects. Relative weaknesses are open, excellent and attractive research systems, finance and support, linkages & entrepreneurship, intellectual assets and Innovators. High growth is observed for community trademarks and sales of new products. A strong decline is observed for venture capital. The new Jeremie II programme foresees €146.4 m venture capital to be invested by the end of 2015 in three different investment categories: seed funding, growth I and growth II. It is expected that these investment will result in several high-growth companies and changing the situation of low share of available early-stage venture capital reported in the Innovation Union Scoreboard. Growth performance in human resources, firm investments, intellectual assets and economic effects is well above average. (IUS, 2011)

Scientific, technological and economic specialization. Research and development activities are highly concentrated in the country in relation to territorial and sectorial dimensions. The capital Budapest and its agglomeration are responsible for almost two-thirds of the national efforts. Apart from the strong territorial concentration, R&D is strongly concentrated in pharmaceutical, electronics, informatics and automotive industries. These sectors constitute about two-thirds of BERD. Another important feature of the Hungarian R&D system is that it is dominated by large multinational companies which are responsible more than half of the domestic R&D expenditures. (NRDIS, 2012)

The structure of the national research and innovation system. Hungary has all the major elements of a potentially successful national innovation system (NIS). The Parliament is the highest-level political decision-making body, while the National Development Cabinet - that has been set up in June 2012 - has the mandate to co-ordinate governmental STI policy decisions. The Cabinet discusses all the decision preparatory documents relevant to development policy and the Cabinet is responsible to establish the rules, procedures and organisational set up to be used when making and implementing decisions concerning the National Strategic Reference Framework for 2014-2020.

The National Innovation Office (NIH) is responsible for the government's technology and innovation policy. Funds allocated through the Operational Programmes of the New Hungary Development Plan (2007-13) are managed by the National Development Agency (NFU). Both the NIH and NFU schemes are administered by an implementing organisation, called the Hungarian Economy Development Centre (MAG Zrt). The governmental decree 1600/2012 (XII.17) made important decisions concerning the planning of utilization of Structural Funds for the next planning period 2014-2020, including the reorganisation of the whole funding implementation system.

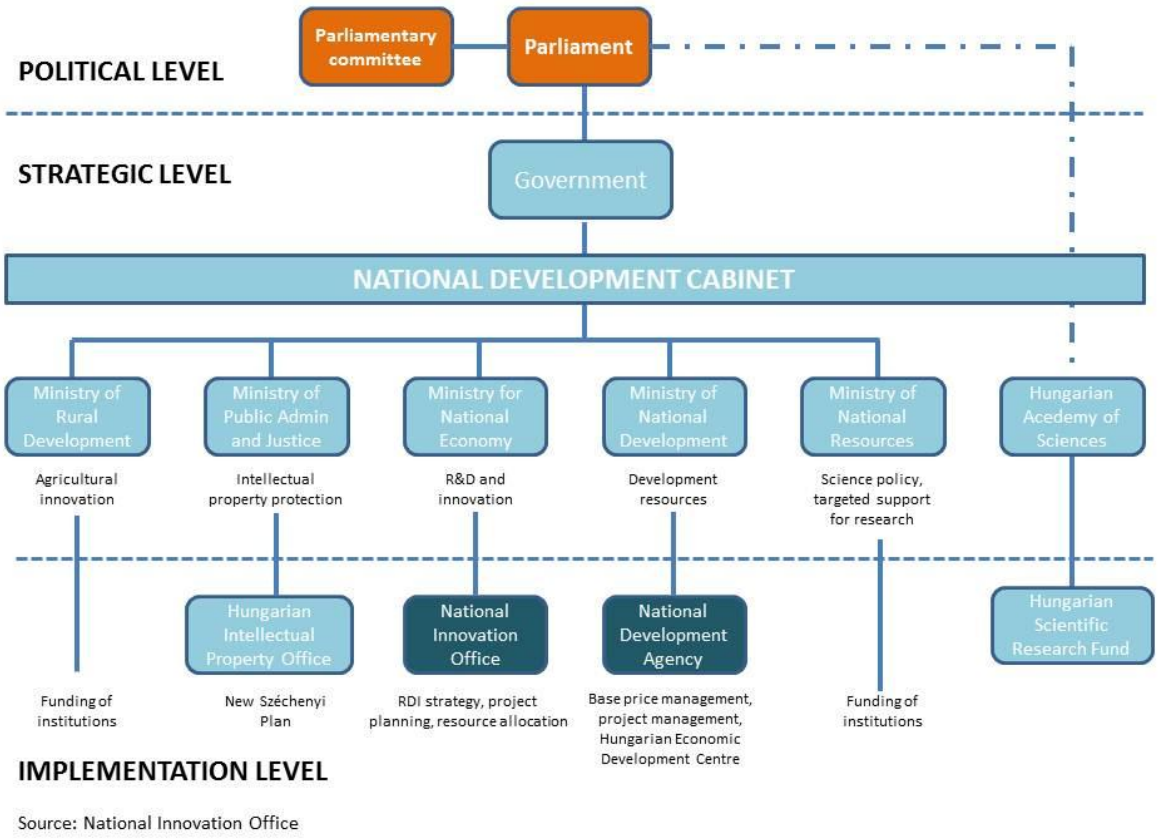
Role of regions in the governance process. Hungary is a unitary state with a centralised decision-making system with regard to major policy domains, including STI policies. Although the regional level has gradually gained more influence in policy-making in general, mainly due to external pressures (EU initiatives, guidelines, etc.), the central government's role in STI policy-making is still dominant. All regions have the same status in terms of overall powers and responsibilities. The traditional sub-national levels of Hungarian policy-making were the 19 counties (plus Budapest) and the municipalities (local governments). With the exception of the largest municipalities, financing major RTDI activities would be unviable at a regional level. Local governments can influence these activities indirectly by operating local industrial parks (or co-operating with them), and offering various advantages (tax exemptions, favourable infrastructural conditions) to investments with a higher knowledge content and/ or more RTDI activities. With regard to STI policy-making, the regional and county levels have not gained a significant role, although the County Development Councils approve "county development programmes" with various STI policy measures, which predominantly follow the priorities of either the Economic Development Operational Programme (2007-2013) or the nationally funded STI policy measures.

With regard to *research performers in the public sector*, the largest number of research units is operated at higher education organisations (1,380 of the total 3,000 in 2011), but the average size of these units is rather small: 4.3 FTE researchers. The HE sector performed 20.2% of the Hungarian GERD in 2011, while the EU-27 average was 23.9%. There are 19 state universities and 9 state colleges as well as further 41 non-state higher education organisations in Hungary. Only two state universities appear in the top 500 ones identified by the Leiden ranking: University of Szeged (SZTE) and Eötvös Lóránd University of Sciences (ELTE).[1]

The government sector's share was 24.9% in 2011 in the total number of (FTE) researchers. This figure reflects a high weight of PROs in the Hungarian innovation system compared to the EU-27 average (12.5% in 2010). The most important player is the Hungarian Academy of Sciences (MTA). The MTA still has a substantial – albeit declining – weight in the Hungarian research system: its share was 12.8% in the total R&D personnel (FTE) and 10.2% of the GERD in 2011.

Businesses have maintained their position as the largest employer of (FTE) researchers since 2006, reaching 50.7% in 2011, and had the biggest share in performing GERD (62.4%), too. Both R&D and innovation activities of firms are highly skewed by size, ownership and sector.

Figure 1 The structure of the Hungarian R&D&I system



Source: National Innovation Office

Note: The institutes of Hungarian Academy of Sciences conduct research, and hence the dual role of MTA is indicated by a combination of colours in the figure.

[1] The Leiden ranking has been calculated by using the mean citation score indicator, and non-English language publications have been included. See at: http://www.leidenranking.com/ranking.aspx

2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 National economic and political context

Hungary was one of Eastern Europe's star economic performers in the first decade of transition but the country was hard hit by the global economic and financial crisis of 2008. In the parliamentary elections held in April 2010, Hungary's centre-right Fidesz party secured a two-thirds majority in the Parliament. This made possible for the government to change so-called fundamental laws, including crucial economic changes, without having to consult the opposition. Apart from new measures to reshape the government, the judiciary and the media, a new Constitution was introduced that is effective from 1st January 2012 which situation led to set off alarm bells across Europe. (Havas, 2012)

According to the economic survey of OECD, the global economic slowdown and heightened financial market stress have pushed an already fragile and highly indebted economy towards recession in 2012. Analysts also say that "unorthodox" domestic policies have also contributed to uncertainty thereby hurting confidence. Stabilising the economy is the foremost pressing priority and the government tries to fix it with all possible tools. Strengthening the credibility and predictability of domestic policies is essential to develop an environment conducive to growth. An agreement with multilateral organisations would help restore confidence and support needed fiscal consolidation. In doing so, it would lower the debt burden in foreign currency by stabilising the exchange rate. The second challenge is to put growth on a sound footing. This requires reductions in households' debt without damaging banks. Finally, raising potential growth is of utmost importance: boosting labour force participation and health outcomes are two promising avenues. (OECD, 2012)

2.2 Funding trends

The government's mid-term STI policy strategy (2007-2013) stipulates that GERD should increase to 1.8% of the GDP by 2013 (up from 1.0% in 2006), while BERD should reach 0.9% of the GDP (from 0.45% in 2006). The Science – Innovation Programme, launched in January 2011, sets similar broad aims as the government's mid-term STI policy strategy (2007-2013), but it stipulates revised quantitative targets:

- R&D and innovation expenditures (that is, not GERD) should reach 1.5% of GDP by 2015, and "approach" 2% by 2020;
- innovation performance, measured by the Summary Innovation Index, should reach the EU average, and Hungary should belong to the top third of EU members in the "next cycle". (p. 234)

The National Reform Programme (NRP), launched in April 2012, repeat the quantitative target set in the NRP 2011: "As part of the research and development objective of the Europe 2020 Strategy, Hungary undertakes to increase the level of research and development expenditures to 1.8 per cent of the gross domestic product by 2020". (NRP, 2012, p. 32)

The draft National Research-development and Innovation Strategy (entitled "Investment in the Future"), published in early November 2012 for public consultation[2] set the target with reference to the National Reform Programme: "Hungary will increase its research and development expenditures to 1.8% of the GDP by 2020 and 3% by 2030". A complementary target of the strategy is that BERD will reach 1.3% by 2020. (NRDIS, 2012, p. 25)

Table 1 Basic indicators for R&D investments in Hungary

	2009	2010	2011	2012 (estimate, if such data are available)	2020 national target	EU-27 average 2011
GDP growth rate	-6.8	1.3	1.6	-1.2		1.5
GERD as % of GDP	1.17	1.17	1.21		1.8	2.03
GBAORD (€ million)	426.6	349.3	491.8			92,308.339
GBAORD as % of GDP	0.47	0.36	0.49			0.73
BERD (€ million)	610.8	673.5	751.9			159,975.937
BERD as % of GDP	0.67	0.7	0.75		1.3*	1.26
R&D performed by HEIs (% of GERD)	20.94	19.93	20.18			23.99
R&D performed by PROs (% of GERD)	20.06	18.52	15.76			12.68
R&D performed by Business Enterprise sector	57.24	59.81	62.42			62.35

Source: Eurostat

* according to the draft National Research and Development and Innovation Strategy published on 6th November 2012.

In 2011, the research and development expenditures increased by 8.5% (current price) compared to the previous year and reached a peak of 1.21% of the GDP from 1.17% in 2010. Between 2005 and 2011, the total research and development expenditures (current price) increased by 62%. The share of research and development investments out of the total national investments also increased from 0.7% to 0.9% in the same period. The majority of the research and development expenditures were devoted to experimental development (45%), while 21% of GERD was spent on basic research (KSH, 2012).

The business expenditures on research and development constitute the biggest share of the total and grew from 39.5% in 2005 to 47.5% in 2011, although stayed almost the same compared to 2010 (47.4%). Public funding decreased from 49.6% in 2005 to 38.1% in 2011, a slight change to the previous year (39.3% in 2010). Research and development funding from abroad has a quite high and slightly increasing share of the GERD (10.7% in 2005 and 13.4% in 2011).

Government budget appropriations or outlays for research and development (GBAORD) had a 18.1% drop in 2010 compared to 2009 mainly because of austerity measures and freeze of certain funding instruments after the new government took office in summer 2010. The GBOARD then increased by 15.3% in 2011 compared to 2009.

The Hungarian GERD/GDP still trails the EU-27 average (2.03% in 2011). In relative terms, the GOVERD is the closest to the EU-27 average (73.1%), while the share of BERD and HERD in GDP is 59.5% and 49.0% of the corresponding EU-27 indicators (Table 2).

[2]The strategy is foreseen to be approved by government decision by early 2013.

Table 2 The Hungarian GERD, BERD, HERD, and GOVERD, 2011

	€ million	Change 2011/2010, %	Share in EU-27 total, %	% of GDP, Hungary	% of GDP, EU-27 average	% of EU-27 average=100
GERD	1204,63	7,00	0,47	1,21	2,03	59,6
BERD	751,95	11,60	0,47	0,75	1,26	59,5
HERD	243,13	8,30	0,39	0,24	0,49	49,0
GOVERD	189,84	-9,00	0,58	0,19	0,26	73,1

Source: Eurostat data, and author's calculation

BERD increased considerably – by 10.27% in 2010 and 11.6% in 2011 – and thus the BERD/GERD ratio jumped from 52.57% in 2008 to 62.41% in 2011, achieving the EU-27 average (62.35%). This increase was financed mainly by public and foreign funds: while the share of businesses in financing BERD decreased from 79.8% in 2008 to 70.8% in 2010, the share of public funds[3] grew from 8.6% in 2008 to 15.5% and 14.0% in 2009-2010.

Institutional – or core – funding is vital for the operation of research units at HE organisations and PROs. There are two principal channels for providing such funding: normative support for R&D activities conducted at HEIs, and support to the Hungarian Academy of Sciences. According to Eurostat GBAORD figures, R&D financed from General University Funds (GUF) – as a proxy for institutional funding – accounted for 28.9% and 23.8% of GBAORD in 2010, and 2011, respectively. The figures for R&D financed from other sources than GUF were 31.7% in 2010 and 38.3% in 2011. This means that more than half of the GBAORD was allocated via core funding in the past two years.

Competitive funding is also a major mechanism for public support to RTDI activities. The largest funds are the Research and Technological Innovation Fund (KTIA),[4] and the various Operational Programmes of the New Hungary Development Plan,[5] while for bottom-up funding is provided by a smaller one, called Hungarian Scientific Research Fund (OTKA).[6] The largest STI policy support schemes are co-financed by the EU Structural Funds, and given the cuts in domestic public funding, the balance has shifted significantly towards EU funds taking into account commitments made in 2010. Actual funding figures are not publicly available, and using that metrics might lead to a somewhat different picture, but probably still with a larger share of EU funds.

The dominant form of support is to provide grants; yet, other tools are also part of the Hungarian STI policy mix. Venture capital, favourable loans, and guarantees do not feature in the financial figures on commitments made in 2010: funds had to be set aside when these schemes started, and then can be used for 10-15 years.[7] Hungary has one of the most recipients of financial engineering instrument (loans, guarantees and venture capital) in the economic

[3] It should be noted that public funds include the EU Structural Funds, too.

[4] The annual budget of the KTIA was in the order of €180-200 m between 2006 and 2009. Between 2010 and 2011 no new tender was launched because of the obligations from previous years. In 2012, about €130 m was available through various research-development and innovation tenders.

[5] The most important element is Priority 1, "R&D and innovation for competitiveness" of the Economic Development Operational Programme (EDOP). Its budget is €990 m for 2007-2013, including 15% national contribution.

[6] The annual budget of OTKA used to be around €20m. Compared to 2011, the annual budget of OTKA grew by 41%.

[7] R&D tax incentives amounted to 0.08% of GDP in 2007. (OECD, 2010, p. 77)

development operational programme. The total number of recipients of these instruments is over 6000 (out which more than 2200 in 2012 (all SMEs).

There are hardly any thematically or sectorally focused support schemes in the Hungarian STI policy mix.

Businesses have to cover certain share of the costs of publicly supported RTDI projects, but public-private partnerships, *per se*, are not used to leverage additional funding. On the contrary, the current government has started revising PPP contracts initiated by the previous government in other domains (e.g. sport, culture, higher education, infrastructure and prison investment projects). (Cseke, 2010)

2.3 New policy measures

Apart from the provision of institutional – core – funding for research and development activities in the higher education sector and PROs, project based funding is a major mechanism for public support to RTDI activities. The two most important financial sources providing competitive funding for R&D activities are the Research and Technological Innovation Fund (hereafter: RTIF), and the various Operational Programmes of the New Hungary Development Plan.

The overall aim of the Research and Technological Innovation Fund (Act XC of 2003) was to create a stable and reliable financial source to support research, technological development and innovation (RTDI) activities. Originally the two most important revenue sources of the Fund were the central budget, and the contribution paid by enterprises (except micro- and small enterprises), that is, the so-called innovation levy. In principal, the government contribution used to be 50%, although according to the evaluation report of the RTIF for the period 2004-2011, public contributions were only met in 2007, 2008 and 2009. (NIH, 2012a) As an incentive to conduct R&D activities, firms were allowed to reduce the contribution to the Fund by the amount of direct costs of in-house R&D activities, as well those of commissioned from universities, public research institutes or non-profit research organisations, financed by own sources of firms.

The budget law for 2011 did not allow to make new commitments to finance RTDI projects from the RTIF, that is, new calls of the on-going STI policy support schemes was not launched, let alone new schemes. Only financial commitments made earlier e.g. in connection to international co-operation and on-going R&D projects could be fulfilled.

From January 2012 on, two fundamental rules, governing the RTIF, have been changed:

- no contribution is to be paid from the central budget in 2012 and
- firms cannot deduct any longer either their intramural R&D expenditures, or the amount they spend on commissioning publicly financed R&D units from the innovation levy.[8]

The RTIF was planned to amount to ~€161.4 m (HUF 45.2 bn) in 2012. (Act CLXXXVIII of 2011 on the 2012 central budget). After two years of suspension several new programme calls

[8] There are controversial views whether beneficiary companies used this incentive in a proper way. Several investigations by the national tax authorities and independent evaluations (e.g. NIH 2012a) lead to a strict qualification procedure of research and development expenditures financed from the Research and Technological Innovation Fund. Based on the Innovation Act (CXXXIV/2004) the Hungarian Intellectual Property Office (SZTNH) has an extended mandate from January 2012. Companies could optionally (ex-ante) ask the SZTNH to review the documentation of the research project (optional for companies) and qualify it as certain type research and development activity. Other national authorities should accept this qualification.

were launched over 2012. As a consequence of the suspension of the RTIF, the demand became so high that the availability of sources got very limited by the end of the year and many calls for applications should be closed before the deadline. (Table 3)

Table 3 R&D&I funding priorities with available funding, 2012

Support areas	Available funding in € million *
International R&D programmes (preparation for the Horizon 2020 programme)	19.6
Support of R&D projects and companies	131.9
Technological development of companies	58.9
Support of R&D&I collaboration (companies, universities and PROs)	60.0
Total funding	**270,4**
Source: Structural Funds	***122.1***
Source: Research and Technological Innovation Fund	***148.3***

Source: National Innovation Office
* 1 euro=280 HUF

The above support areas cover several measures that are basically a continuation of previous ones with the exception of "support to RTDI umbrella projects" (ERNYO12) and "R&D competitiveness and excellence contracts" (VKSZ12). The former measure aims at supporting so-called umbrella RTDI projects (i.e. a set of new RTDI projects) of large firms so as to promote the dynamic growth of business RTDI activities in Hungary. These new RTDI projects are supposed to lead to new S&T results and new R&D jobs. Foreseen funding available from RTIF is ~€39.3 m in 2012.

The second new measure (VKSZ12) aims at supporting those strategic research and development activities that contribute to the competitiveness of Hungary with creation of new R&D jobs, initiating strategic collaboration with PROs, development of prototypes of new, marketable products, technologies and services that contain significant intellectual added value as well as development of sectoral networks indicated in the Science and Innovation Programme of the New Széchenyi Plan. This measure especially aims at further development of the results achieved by development pole and national technology platform programmes. The measure consists of two sub-programmes: a) integrated R&D projects and b) societal challenges. The foreseen funding available for this measure from RTIF is ~€33.6 m in 2012. Although according to the call publish on 20th December 2012, the winning consortia (3-6) could get additional ~€78.6 m between 2013 and 2019.

In addition, it should be also mentioned that within the New Széchenyi Plan's Science and innovation programme launched in 2010, there were 6426 applications received in the value of HUF 607 bn (€2.167 m) out of which 3658 applications were approved in the value of HUF 191 bn (€682 m). In relation to the availability of funds commitments have been made up to a very high extent which is good though on the other hand looking at payments and condition of realization of innovation projects there is a possibility of loss of resources in innovation.

2.4 Recent policy documents

The main purpose of the **National Reform Programme 2012** (NRP) is to introduce measures for dynamic economic growth, boosting employment, ensure sustainable level of public debt, while following the guidance by the European Commission for structure and content of presentation. Majority of growth enhancing measures are structured according to the priorities of the Annual Growth Survey, while measures directly aimed at the attainment of national targets of the Europe 2020 Strategy are presented in thematic chapters.

NRP 2012 sets targets and measures in other policy domains, too:

- employment;
- research and development;
- climate change, energy efficiency;
- education;
- social inclusion.

As for R&D and innovation, the main goals are set as follows: "... it is necessary to renew the relevant strategy and to create a regulatory environment that is conducive to innovation. The most important objectives are to broaden the current narrow base of corporate innovation, to reinforce research institutes that are able to join international cooperation on equal terms, to attract direct foreign capital investments in research and development and to develop high-growth, innovative and knowledge- intensive businesses („gazelles").

As part of the research and development objective of the Europe 2020 Strategy, Hungary undertakes to increase the level of research and development expenditures to 1.8 per cent of the gross domestic product by 2020." (p. 32)

The document foresaw the approval of "the National Innovation Strategy" by the end of 2012. According to NRP 2012, the innovation strategy will provide a framework for the planning of the national or regional smart specialisation strategies which constitute one of the ex-ante conditions of access to cohesion funds during the period 2014-2020. As promised "During the planning of the innovation strategy, in 2012 we shall review the relevant international policies and best practices, evaluate the local processes and, based on these, attempt to enforce modern innovation-policy approaches that may even reflect a new paradigm. The first short-term action plan will also be developed as part of the planning of the National Innovation Strategy". (NRP, 2012, p.33)

With delay concerning the timing set by the NRP 2012 in April 2012, the Ministry for National Economy and the National Innovation Office published the **draft National Research and Development and Innovation Strategy 2020** entitled "Investment in the Future" in early November 2012. The draft strategy contains a comprehensive situation analysis, followed by the SWOT analysis of the Hungarian innovation system. Based on these analyses the following three main problem areas were identified (NRDIS, 2012, p. 21):

- Weaknesses of the knowledge bases and knowledge production:
    - lack of knowledge centres that are competitive at global scale
    - fragmented, not focused R&D activities at public research centres
    - spin-off processes are often get stuck

    - outdated scientific education, continuous reform of education
    - not sufficient resupply of researchers
    - eroded R&D infrastructure
    - not sufficient and oscillating R&D funding
    - not enough attention paid to socio-economic processes

- Weaknesses of knowledge and technology transfer:
    - weak inter-sectoral (company-research centre) links
    - insufficient incubation
    - weak participation in international R&D activities and network
    - slow growth of venture capital
    - lack of state innovation management services
    - insufficient support of technology transfer
    - lack of RTDI managers at international standards

- Hindering factors of knowledge exploitation activities of companies:
    - low efficiency of adaptive innovations
    - weak medium-size companies
    - low number of new, small (R&D-based) high tech companies
    - spin-off processes are often get stuck
    - not stable R&D tax regimes
    - few R&D result seeking multinational companies that are embedded in the national economy
    - few market driven development activities, low demand, competition of "giants"

In terms of specific objectives, the draft strategy set the target with reference to the National Reform Programme: "Hungary will increase its research and development expenditures to 1.8% of the GDP by 2020 and 3% by 2030". A complementary target of the strategy is that BERD will reach 1.3% by 2020. (NRDIS, 2012, p. 25).

Apart from the overall objectives, the strategy specifies how the overall R&D capacities could be raised by 2020. The quantitative targets are the following:

- additional 30 research and technological laboratories join the world's elite,
- 30 new global R&D centres settle down or become stronger,
- 30 R&D intensive domestic medium-sized companies appear in the Central and Eastern European region, and
- 300 fast growing, R&D intensive small enterprises ("gazelles") enter the international market with success.

The draft strategy foresees a purposeful system building according to three priority axes with the following specific targets: (NRDIS, 2012, p. 38)

- internationally competitive knowledge bases:

- A.1. education and support of talent
- A.2. internationally competitive R&D infrastructure
- A.3. reinforcement of research centres (PRO and HE)
- A.4. modern research management

- support of efficient knowledge and technology transfer collaborations:
  - B.1. efficient state innovation services
  - B.2. introduction of decentralised innovation services
  - B.3. strong, traditional innovation collaborations
  - B.4. support of open, pre-competitive and social innovation collaborations
  - B.5. efficient participation in EU and international tenders and initiatives
  - B.6. efficient networked economy
- companies that exploit intensively the results of modern S&T:
  - C.1. building of a start-up ecosystem
  - C.2. facilitation and speeding up of intellectual property protection
  - C.3. creation of demand for R&D at medium sized companies
  - C.4. efficient support for internationalization
  - C.5. cautious state demand for innovation
  - C.6. high knowledge content jobs at large companies with intensive local knowledge connections
  - C.7. increasingly innovative, diversifying supplier SMEs
  - C.8. acceleration of spreading of adaptive innovation solutions, mainly based on ICT
  - C.9. the most competitive R&D tax incentive system in Europe

The expected results of the above specific targets are: the stimulation of RTDI demand, establishment of an efficient support and funding system as well as the completion of the start-up ecosystem. The systemic development of the elements of the RTDI will require periodic comprehensive evaluation of the strategy.

Between early November and early December 2012, the public consultation process of the draft national innovation strategy had 4 events in large Hungarian cities and one main consultation event was organised in Budapest. Besides these events organised by the Ministry for National Economy and the National Innovation Office, all public had the chance to comments on the draft strategy via e-mail by 4th December 2012. According to the plans, the final version of the strategy, taking into account the recommendations and remarks from the public consultation, will be approved by government decision by early 2013. Afterwards, action plans will be adapted to the strategy, which will be the basis for the implementation.

The Hungarian Parliament passed a new **Law on Higher Education** (Act CCIV) on 23 December 2011 that took into force from January 2012. The new law set clear rules for the operation of the higher education orgasations, their under-graduate, graduate, master and doctoral courses as well as qualification requirements, and obligations of students. The law foresees 19 state universities, 9 state colleges, two private universities and eleven private colleges.

According to the law (§ 10 of Act CCIV), in the sake of fulfilment of national strategic objectives, the government might qualify with its resolutions certain universities or faculties as "research university / faculty" or "college of applied sciences". The new law introduced a three-level financing system that will have serious impact on the funding of higher education. In the new financing system, there will be students a) who pay full costs, b) get part-studentships and c) state studentships.

The **Széll Kálmán Plan**, on which the Hungarian National Reform Programme is based, sets out "structural reforms to enhance economic growth" and further measures in various policy domains, among others in the education policy too. The intention of the government in the education policy domain is to reduce higher education expenditures funded by the state and support especially science and engineering education. The changing funding focus of the government includes the withdrawal of state funding from law and business education to be financed from the market in the future. From the academic year started in September 2012, the state only covers the education costs of 30,000 new students (compared to 53,000 in 2011) and partly finance (in 50%) additional 15,000 new students.[9] The most drastic decrease happened to law and economic education, where the state only covers the costs of 100 law and 250 economist students. In these highly popular education areas, the decrease of state funding was about 95% compared to previous years.

These new measures caused several debates among the rectors and professors as well as triggered some student protestations especially in December 2012.

The **government resolution 1600/2012** (XII.17) made important decisions concerning the planning of utilization of Structural Funds for the next planning period 2014-2020. The most important general rules and guidelines of the resolution are the following:

- resources of the Structural Fund should be used for the reinforcement of the growth potential of the Hungarian economy, hence the share of funding for economic development purposes should be increased;
- during the planning, reinforcement of high added value production and employment should be considered as a strategic objective, bearing in mind the development priorities of the National Development Concept, the National Territorial Development Concept[10] as well as the objectives and measures set by the National Reform Programme;
- resources of the Structural Funds should be possibly utilised in a concentrated way, by focusing upon few priorities to avoid the fragmentation of the resources;
- the establishment of the new organisational structure responsible for managing the Structural Funds 2014-2010 should be done in a way to secure the smooth closing of programmes and potentially full absorption of funds in the current planning period;
- 60% of the development resources should be directly spent on economic development purposes, while the remaining 40% should be devoted to human resource and infrastructure development, environmental protection and energy rationalization;
- it should be pursued to prefer non-refundable support measures from the available resources while minimizing co-funding requirements;
- it should be ensured that public recipients could get a simplified access to funding resources that would differ from the general procedure;

[9] According to estimates of university rectors, there are only 4-5,000 partly financed students admitted in the academic year 2012/2013.

[10] Public consultation of both concepts has been in process since November 2012. (see NDC, 2012)

- the planning of the resources should consider the territorial principle, with special attention to the planning of the territorial operational programmes, where efficient collaboration of the counties should be ensured

According to the government resolution, the foreseen structure of the operational programmes (OP) for the Structural Funds 2014-2020 is the following:

- economic development and innovation OP;
- competitive Central-Hungary OP;
- territorial and settlement development OP;
- intelligent transport development OP;
- environmental and energy rationalization OP;
- human resource development OP;
- coordination OP and
- rural development and fishery OP.

2.5 Research and innovation system changes

The National Research, Innovation and Science Policy Council (NKITT) had been set up in December 2010 to co-ordinate governmental STI policy decisions. It was chaired by a deputy prime minister, co-chaired by the president of the Hungarian Academy of Sciences (MTA), and the members were three ministers with key responsibilities in devising STI policies, that is, the politicians heading the Ministry of National Development, the Ministry for national Economy, and the Ministry of Human Resources.

NKITT was dissolved on 2 July 2012 when a new body, called **National Development Cabinet** (NFK) was set up. NFK is chaired by the prime minister, and the members are the state secretary heading the Prime Minister's Office, the ministers responsible for the national economy, and national development, respectively. In brief, all major development policy issues, large-scale development projects or support schemes (with a budget of more than HUF 1 bn), including those supporting RTDI activities, should be discussed and approved by NFK.

The largest PRO, the **Hungarian Academy of Sciences** (MTA) was reorganised, its former 38 research institutes and 2 research centres were merged into 10 research centres and 5 research institutes from 1 January 2012. In the period between 2012 and 2013, further structural changes and "disciplinary fine-tuning" were foreseen. During this phase, the renewed research centres and institutes will be developing their own strategies, while strengthening the infrastructure of the entire institute network. The main theme of the third phase of the programme is the renewal of the research funding system. A tighter co-operation between the research networks of the Academy and those of the universities is to be achieved by eliminating administrative obstacles, increasing the effectiveness of MTA research teams, and by establishing a common infrastructural development.[11]

The **Regional, County and District Development Councils** were dissolved with effect of 31 December 2011. (Act CXCVIII of 2011) Their tasks are to be performed by county-level authorities. The seven Regional Development Agencies were nationalised by the same law. The new regulation made possible to set up regional and county development consultancy for to give

[11] For further details see http://mta.hu/news_and_views/has-network-of-institutes-up-for-renewal-128954/

opinion on regional development concepts, as well as to propose regional development ideas, projects. The law was initiated by the Ministry of National Development to improve the efficiency of governance and public policies.

Regional Innovation Agencies (RIÜ) used to co-operate closely with the Regional Development Councils, some of the agencies were co-owned by them whose shares mainly went to county councils. The future operation of the RIÜ network, consisting of 7 agencies, has become uncertain during 2012. The survival of the agencies mainly depends on their ability to raise revenues via providing various advisory and consultancy services (e.g. in the field of innovation management and project proposal writing) or applying support from domestic and EU funds, because they don't get any direct financial support from the government.

2.6 Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3)

The preparation of the regional smart specialization strategies (RIS3) has started early 2013. The Ministry for National Economy requested the National Innovation Office to coordinate the production of those strategies and carry out the societal consultation process. The RIS3 strategies are produced by the regional innovation agencies and will be completed in April 2013.

2.7 Evaluations, consultations

STI policy evaluation culture is weak in Hungary. As for the nationally funded support schemes, one of the basic principles of the Law on Research and Technological Innovation (Act CXXXIV of 2004) was that publicly financed STI policy measures shall regularly be evaluated by independent experts. Based on the Law, the Government Decree no. 198/2005 specifies the precise range of measures to be evaluated ex-post. As a general rule, one-off schemes above HUF 1 bn (€4 million) are to be evaluated within 3 years following the closure of the scheme, whereas continuous programmes (with a cumulated funding over HUF 1 bn) within 2 years of the closure of the given programme cycle. For continuous programmes, irrespective of the volume, ex-post evaluation is compulsory within 4 years of the launch of its first call. Despite these stipulations, only four external evaluations have been conducted by the end of 2010 and no new evaluation was carried out since then.

A **comprehensive assessment study** about the operation of the Research and Technology Innovation Fund (KTIA) 01.01.2004 – 31.12.2009 was prepared by a consortium of Ernst&Young and GKI Economic Research Co. The study concludes that the Research and Technology Innovation Fund has had a favourable and quantifiable impact on the Hungarian economy as a whole, despite the occasionally still persistent and considerable flaws in the institutional environment, planning and execution. The favourable impacts are expected to increase once the problems identified regarding STI policy governance and Fund management are addressed in line with the recommendations in this report.[12]

In addition to and based on the conclusions of the above comprehensive assessment study, the National Innovation Office published a report "**Analysis of the utilisation of the project portfolio financed by the Research and Technological Innovation Fund between 2004**

[12] For further details see http://www.nih.gov.hu/english/evaluations/comprehensive

and 2011". The report highlights the following target areas, where the fund made significant contributions:

- strategic, large R&D tenders;
- knowledge centres;
- regional innovation;
- company RTDI and networking;
- tenders supporting international collaboration.

The main conclusion of the analysis was that the Research and Technology Innovation Fund contributed to the maintenance of the R&D expenditures and in a less extent to the creation / keeping R&D jobs. Also, it has been proposed to secure the survival and further development of the results achieved with the stabilization of the role of the Fund. In sum, the operation of the Fund had beneficial and measureable impact on the national economy as well as played an essential role in the maintenance of the level of state R&D funding even if there were some deficiencies in the organisational background, planning and implementation. (NIH 2012a)

Following the EU rules, schemes co-funded by the **EU Structural Funds** must be evaluated. Results of ex-ante, mid-term and ex-post evaluations of various programmes and schemes could be found on the National Development Agency's website.[13]

The Ministry for National Economy and the National Innovation Office launched a **public consultation** process after release of the draft National Research and Development and Innovation Strategy 2020 entitled "Investment in the Future" in early November 2012. For further details see 2.4 section of this report.

2.8 Policy developments related to Council Country Specific Recommendations

In its Country Specific Recommendation (CSR) No. 5 (11257/12, on 12 July 2012), the Council of the European Union recommended that Hungary should take action within the period 2012-2013 to provide specific well-targeted incentive schemes to support innovative SMEs in the new innovation strategy. In the CSR No. 5 only this recommendation has a direct link to research and innovation policy, therefore this issue will be discussed below.

The Council found that the GERD target (1.8% of the GDP by 2020) is ambitious, although it is on track. Eurostat data also confirm that research and development expenditures increased by 7% (in euros) in 2011 (the latest available year) compared to 2010. Unfortunately, the slow GDP growth (-1.5% forecasted for 2012, +0.3% in 2013 and +1.3% in 2014) also supports in negative terms achieving the quantitative target.

The draft innovation strategy puts a strong emphasis on the support of innovative SMEs. They are specifically named as key players of the national innovation system. Also, two out of the four quantitative targets specifically address innovative SMEs:

- 30 R&D intensive domestic medium-sized companies appear in the Central and Eastern European region, and

[13] See http://www.nfu.hu/evaluation

- 300 fast growing, R&D intensive small enterprises ("gazelles") enter the international market with success.

In Section 3.6 of the draft strategy, where the quantitative indicators are summarised, there is an additional target set "provision of support for 1000 start-up companies". Furthermore, an indirect target of the strategy is to increase the share of innovative companies (with more than 10 employees) to 30% by 2020 to address their relative weak performance in the Innovation Union Scoreboard. (NRDIS, 2012, p. 35)

As presented in Section 2.4 of this country report, the draft National Research-Development and Innovation Strategy foresees a purposeful system building according to three priority axes. One development priority axis specifically aims at the development of the Hungarian start-up ecosystem. The foreseen measures are the following: (NRDIS, 2012, p. 31)

1) supporting the establishment and operation of technology incubation system for young enterprises;
2) provision of start-ups with complex service system (e.g. mentoring and vouchers) to improve their survival chances;
3) supporting young enterprises to get prepared for financing from the market;
4) reinforcement of seed and venture capital funds, provision of stabile, market conform financial and legal framework as well as tax regimes;
5) supporting the availability of well-prepared project managers and reviewers with training and accreditation;
6) supporting the matching of potential investors and RTDI projects to be ready for investment;
7) involvement of international start-up and early stage investors to transfer their knowledge and contact network;
8) amendment of the law on venture capital and clarification of incentives mechanisms.

In addition to the above measures that are dedicated explicitly to innovative SMEs, the draft strategy also foresees positive discrimination of innovative SMEs in certain restricted areas of pre-commercial procurement (PcP). According to this draft, innovative SMEs could benefit from the support to be provided for web-based social innovation techniques such as for crowd-funding and crowd-sourcing solutions.

3 STRUCTURAL CHALLENGES FACED BY THE NATIONAL SYSTEM

According to the last available Innovation Union Scoreboard, Hungary is one of the moderate innovators. Hungary belongs to a group of countries characterised by an overall innovation performance below that of the EU-27, together with the Czech Republic, Greece, Italy, Malta, Poland, Portugal, Slovakia and Spain. (IUS, 2011) These countries are rather diverse, e.g. in terms of their size, structural composition of the economy, level of socio-economic development, and historical legacy. Thus, it is crucial to identify the major structural features and challenges of the Hungarian national innovation system (NIS). That is a first step to better understand these issues, to be followed by adequate policy replies, bearing in mind the limitations of policies.

The relative strengths of the Hungary are in human resources and economic effects (i.e. medium and high-tech product as well as knowledge-intensive services exports). Relative weaknesses are open, excellent and attractive research systems, finance and support, linkages and entrepreneurship, intellectual assets and the share of innovators. High growth is observed for community trademarks and sales of new products. Growth performance in human resources, firm investments in R&D, and economic effects is well above average. (IUS, 2011, p.40)

Table 4 Selected Innovation Union Scoreboard indicators

	Current performance	EU-27 average	Growth performance
ENABLERS			
Human resources			
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	0.9	1.5	6.5%
Percentage population aged 25-64 having completed tertiary education	27.7%	33.6%	7.8%
Open, excellent and attractive research systems			
International scientific co-publications per million population	352	301	3.5%
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	5.38	10.73	1.4%
Finance and support			
R&D expenditure in the public sector as % of GDP	0.44	0.76	-3.1%
FIRM ACTIVITIES			
R&D expenditure in the business sector as % of GDP	0.69	1.23	8.9%
Linkages & entrepreneurship			
Public-private co-publications per million population	19.6	36.2	2.3%
Intellectual assets			
PCT patents applications per billion GDP (in PPS€)	1.31	3.78	-0.5%
PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	0.36	0.64	-1.0%
OUTPUTS			
Economic effects			
Medium and high-tech product exports as % total product exports	68.03	48.23	-0.4%
Knowledge-intensive services exports as % total service exports	28.88	48.13	6.0%
License and patent revenues from abroad as % of GDP	0.51	0.77	3.5%

Source: Innovation Union Scoreboard 2011

In comparison with the EU-27 average, the innovation performance of Hungary particularly lags behind in innovation collaborations, mainly between PROs and companies, although the cluster programme within the innovation priority of the Economic Development Operational Programme (EDOP) specifically aims at strengthening these collaborations. Collaboration is very weak between SMEs and large domestic as well as multinational firms, in particular with the knowledge bases. On the contrary, Hungarian PROs and universities have relatively strong connections to foreign research units. This means that scientific aspects of collaborations prevail against practical utilization and industrial exploitation. An untapped opportunity has been so far the start-up ecosystem (e.g. incubation and support available for knowledge and technology-intensive start-ups) that is rather weak and underdeveloped. Spin-offs and start-ups often get stuck in their initial phases. In 2013, several new measures will be launched that will specifically support the start-up development processes. Apart from these new measures, it should be mentioned that the venture capital programmes (Jeremie I and Jeremie II) also aim supporting start-ups. Similarly, technology transfer processes and support mechanisms are rather inefficient. Apart from these insufficiencies, domestic medium sized companies carry out generally low R&D intensive activities therefore they have low demand for RTDI services. The share of innovative small companies is rather low and they generally lack of capacities and capabilities for the implementation of innovative development strategies. Also, they often lack of company culture, global view, skills, experiences as well as material and human resources needed for bringing innovative products, technologies and services successfully to the market. (NRDIS, 2012)

Based on a SWOT analysis, the draft NRDIS sets out the main problem areas of the Hungarian NIS in the following[14] (NRDIS, 2012, p. 20):

- *Weaknesses of the knowledge bases and knowledge production*: the evolution of knowledge production processes with high added value is slow, because of scarce researchers supply, difficulties of scientific-technological education and low number of research centres competitive at international level.

- *Weaknesses of knowledge and technology transfer*: knowledge transfer organisations are weak, although university technology transfer centres are established at all main universities, but they have only 3-5 years experiences of operation. These intermediary organisations are not yet ready to mediate between academia and business efficiently and transfer the research results produced towards companies. This could have severe impacts on the production of higher added value goods and services and last but not least on the economic catching up of the country to EU-27 average.

- *Hindering factors of knowledge exploitation activities of companies*: it is one of the main consequences of the dual economic structure (i.e. on the one hand, highly developed multinational companies embedded in global supply chains that carry out significant R&D activities and domestic small and medium sized firms pursue for survival with no or very low level of R&D activities on the other hand) is that multinational companies operating in Hungary are able to purchase most modern technologies and acquire management knowledge, domestic small companies could not leap frog their lagging innovation performance.

Based on the ERAWATCH country reports produced in the previous years (i.e. Havas, 2010 and Havas, 2012), the situation analysis of the draft national research and development and

[14] See details of the problem tree identified in the draft NRDIS in Section 2.4 of this report.

innovation strategy, the IUS and other data presented above, five major structural challenges of the Hungarian NIS are highlighted. These challenges are fairly similar to those of the previous year as the situation and framework conditions for RTDI have not changed much.

1) *Low level of innovation activities, especially that of the SMEs*

Only about one-fifth of enterprises introduce product or process innovations in Hungary, with no major change since 2002. This ratio is even lower for SMEs. According to IUS 2011, only 12.6% of them introduced product or process innovations, that is, 42% of the EU-27 average. Unfortunately, this trend is negative with a slight drop of 1.2% compared to the previous period.

2) *Low occurrence of co-operation in innovation activities among key actors*

Innovation processes draw on different types of knowledge and skills, often possessed by various types of actors. Co-operation among them is, therefore, indispensable for successful exploitation of knowledge. At an aggregate level, the frequency of innovation co-operation reported by Hungarian firms is higher than in most EU countries (Hungary is ranked 6 with 41.3% in CIS 2008; the EU average is not available). Yet, only 6.5% of innovative firms reported any form of co-operation with Hungarian "government or public research institutes", and with that figure Hungary ranked 16 among the EU countries. Furthermore, small innovative firms co-operate less frequently with their clients or customers than large innovative companies. This issue can be taken as a specific feature of a broader challenge, that is, the dual economy syndrome: the Hungarian economy is composed of highly productive and technologically advanced foreign-owned large firms, on the one hand, and fragile, financially and technologically weak indigenous SMEs, on the other. This challenge, therefore, would need attention both by STI and economic policy-makers.

3) *Insufficient quantity and supplement of human resources for R&D and innovation*

The future of R&D and innovation activities is predetermined by the quality and quantity of scientists and engineers, and the level of skills more generally. Yet, both the share of S&E graduates and the rate of participation in life-long learning are rather low in international comparison. A significant gap might be opening between the supply and demand for qualified science and engineering (S&E) personnel in the near future. The number of graduates (ISCED 5-6) in mathematics, science and technology per 1 000 of population aged 20-29 grew from 5.8 in 2006 to 7.5 in 2009, that is, 52.4% of the EU-27 average (14.3).

According to the IUS 2011, the share of doctoral graduates in the 25-34-year age group increased from 0.6 (per 1,000 people) in 2006 to 0.9 in 2009, but it was still only 60% the EU-27 average (1.5). Even though the trend shows improvement, the number of PhD degree holders is forecast to be insufficient in the medium run for maintaining the quality of the Hungarian research system. (Tamás et al., 2005) In addition, the share of population aged 30-34 having completed tertiary education increased from 14.8% in 2000 to 25.7% in 2009, reaching 76% of the EU average (33.6%). Further, brain drain seems to be an element of this broad challenge: it is primarily the highly qualified, young workers, especially those with S&E degrees that are overrepresented within the group of Hungarians working abroad. (Csanádi et al., 2008)

4) Unfavourable framework conditions for innovation

The macroeconomic situation, the structure of the economy, the overall entrepreneurship culture together with the intensity and type of competition seem to influence firms' behaviour with such a power that STI policy schemes cannot offer strong enough incentives to overrule these unfavourable effects.[15]

5) Deficiencies in the STI governance system and the institutional framework

The shortcomings in the Hungarian STI policy were identified in the last OECD Review on Innovation Policy in 2008. In this report four aspects of policy failures are highlighted: (i) lack of political commitment, (ii) instability, (iii) shortfalls in implementation, (iv) slow, insufficiently informed policy learning processes. (OECD, 2008, pp. 15-16)

The situation neither have improved nor stabilised much so far because there was another wave of reorganisation of major STI policy-making bodies and the RTDI funding structure introduced by the new government since 2010. The National Research, Innovation and Science Policy Council (NKITT) had been set up in December 2010 to co-ordinate governmental STI policy decisions. After one and a half year operation, the NKITT was dissolved on 2 July 2012 when a new body, called National Development Cabinet (NFK) was set up.

The draft innovation strategy (published in November 2012) also reflects some uncertainties concerning the implementation structures of the strategy. Apart from lacking of clearly indicated responsibilities, the main issue is that government bodies responsible for policy design and policy implementation have no critical mass in experienced professionals. The same is true for intermediary organisations, including those at the regional level, and particularly the regional innovation agencies. Unfortunately, all these bodies are rather small, they have a scattered portfolio of activities, duplicate each other's efforts and often lack long-term funding commitments. These circumstances do not help attracting and keeping well trained professional employees.

Taking into account of the above shortcomings, no 'quick fix' of the STI governance system and institutional framework seems possible.

[15] For more details, see Havas (2011); Havas and Nyiri (2007); and OECD (2008).

4 ASSESSMENT OF THE NATIONAL INNOVATION STRATEGY

4.1 National research and innovation priorities

The Government's mid-term STI policy strategy (2007-2013) defines six priorities:

- "Expansion of companies' research and development activities;
- Establishment of internationally recognised research & development, innovation centres and research universities;
- Enhancing of the regions' research & development & innovation (R&D&I) capacity;
- Establishing a knowledge market which works on the principles of performance recognition and competition through the globalization of knowledge production and dissemination;
- Investment in large scientific facilities, primarily in the regional centres and the development poles, reducing regional differences (regional cohesion);
- The dynamic increase in yearly R&D expenditure, above all as a result of growth in corporate expenditure." (Government 2007, p. 3)

A new science and innovation policy document, entitled Science - Innovation Programme, was published in January 2011. It is a chapter in the broader New Széchenyi Plan (Hungarian acronym: ÚSzT). The Science – Innovation Programme (hereafter SIP) offers an overview of the Hungarian national innovation system, highlights strengths and weaknesses – based on the 2009 European Innovation Scoreboard indicators, as well as on the OECD review of the Hungarian innovation policy (OECD, 2008). According to the Science – Innovation Programme, the main tasks of innovation policy are the following:

- increasing the R&D and knowledge intensity of the Hungarian economy, support of innovative companies with high growth potential in the production and service sector, increasing of innovation and absorption capacities of SMEs, development of innovative clusters;
- reinforcing of fragmented knowledge infrastructures in Hungary, improvement of the capabilities in order they contribute to the implementation of national economic targets;
- setting R&D priorities and appointing of economic sectors that could be converted into leading sectors of the economy;
- continuous monitoring and assessment of the RTDI expenditures as well as the results, impact of science and innovation policy measures as well as provision of feedback to planning;
- simplification of RTDI tender procedure and administration of funds, decreasing the "red tape";
- ensure full publicity and personal responsibility at decision-making and preparation;

- establishment of a stable organisational structure – including coordination mechanisms at both vertical and horizontal level – in order to the definition and implementation of longer term innovation strategy. (Government 2011, p. 233)

The Science – Innovation Programme set priorities at three levels: horizontal, thematic / sectoral as well as creative industries. The horizontal priorities are human resources development, incentives for domestic innovative SMEs, international collaborations, restructuring of the governance of the NIS and legal rulemaking. The thematic / sectoral priorities of SIP are as follows: automotive industry, mobility and logistics; health industries (pharmaceuticals, medical biotechnologies and instruments, balneology); ICT; energy and environmental technologies; creative industries. The SIP provides a short situation analysis of the above thematic / sectoral fields than sets target for each particular field, followed by proposed measures for implementation that are illustrated in the following:

i) **automotive industry**:

- establishment of innovation incubators in large Hungarian cities where automotive firms are concentrated (i.e. Győr, Kecskemét, Budapest and Miskolc);
- reconstruction of RTDI capacities and capabilities of domestic bus production;
- increasing of the efficiency of traditional vehicle drivelines;
- development of certain components and subsystems of electric and hybrid drives;

ii) mobility and logistics:

- development of intelligent vehicle systems;
- development of traffic systems;
- change to eco-efficient driving systems;

iii) health industries:

- supporting the resupply of RTDI staff in pharmaceutical industry;
- establishment of accredited clinical laboratories for full spectrum of clinical tests (Phase I, II and III);
- supporting the establishment of biotech RTDI and manufacturing culture as well as the resupply of human resources.

The most recent STI policy document, the draft National Research-development and Innovation Strategy, published in November 2012 does not define thematic / sectoral priorities. As put in the introduction: "…it is risky if politics and the state defines future lead industries. Therefore, the draft strategy for public consultation does not provide sectoral directions". (NRDIS, 2012, p. 5)

It should be mentioned that apart from STI policy documents presented above, the draft National Development Concept for the period until 2020 sets sectoral priorities, development policy tasks for these priority fields and foresees the elaboration of sectoral strategies for ten selected sectors: 1) automotive, 2) ICT, 3) Health industry, 4) Pharmaceutical industry, 5) Tourism, 6) Agriculture, food-processing, 7) Construction and production of construction materials, 8) Logistics, 9) Machinery and 10) Chemistry. (NDC, 2012)

4.2 Evolution and analysis of the policy mixes

The Innovation Union self-assessment tool (IU SAT 2010) provides an appropriate framework to review and analyse the evolution of the R&D and innovation policy mix. With the application of this tool, the main features of the Hungarian innovation system are presented in the following.

Promoting research and innovation (IU SAT, item 1) is often mentioned as a key policy instrument to enhance competitiveness and job creation, address major societal challenges, and improve quality of life. Although policymakers mention frequently the importance of RDI, research and innovation does not seen as a key policy instrument to improve the competitiveness of the Hungarian economy in the past few years, similarly to past decade. Apparently, there are more relevant policy intervention areas than RTDI. Still, RTDI is the on the priority list as government programmes and policy documents (including cohesion and territorial development concepts, strategies) put strong emphasis on RTDI, especially in their situation analyses and objectives, nevertheless the implementation is lagging behind. Recent government documents and concepts as well as the National Reform Programme are fairly consequent with the RTDI target (1.8% of the GDP by 2020) which is still lower than the EU-27 average but seems to be approachable maintaining the past years' dynamic.

Priority setting and sectoral specialization appear often controversially in policy documents. As mentioned in the previous Section 4.1, the draft innovation strategy does not define thematic / sectoral priorities, even finds it risky if policymakers pick sectors. The point is that evidence and data specifically underpin the most innovative and competitive sectors of the Hungarian economy. The bulk of the BERD is spent by pharmaceutical industry, ICT, automotive and machinery as well as business services. (NRDIS, 2012, p.14) In this sense, it can be perceived as a positive development that the draft National Development Concept foresees the elaboration of sectoral strategies in 2013.

Design and implementation of research and innovation policies is steered at the highest political level and based on a multi-annual strategy. (IU SAT, item 2) There has (almost) always been a high-level political body to co-ordinate policy efforts. However, *stability* is not the mayor characteristics of the Hungarian STI governance system that underwent several reorganisations in the past few years. The latest change (as of 2nd July 2012) has been the establishment of the National Development Cabinet chaired by the prime minister. Basically, all major development policy issues, large-scale development projects or support schemes, including those supporting RTDI activities, should be discussed and approved by this committee. Principally, this highest level political steering could ensure the definition of broad policy orientations, although decision-making is rather ad-hoc than based on multiannual planning that could bring stability for the actors of the innovation system. The situation became more complex and *regional level governance became weaker* after the dissolution of Regional Development Councils in effect from January 2012. Apart from, and partly in connection, to this decision, the future of important regional intermediaries, such as the Regional Innovation Agencies became uncertain. These organisations played and could play a relevant role in the improvement of regional framework conditions for innovation and support local SMEs with their innovation management services. The annual report of the National Innovation Office has foreseen collaboration with the regional innovation agencies in sake of support regional innovation, finally no decision was made until the end of 2012. (NIH, 2011)

In this situation, it is not surprising that there is no information available on the status of regional smart specialization strategies (RIS3) that are required for the planning of the Structural Funds in the period between 2014 and 2020.

The establishment of the Science and Technology Observatory (called Kaleidoscope information service) within the National Innovation Office could be seen as a mayor improvement towards *evidence-based planning and policy design* in 2012. After several years of planning, this new service of NIH provides stakeholders of the innovation system with reliable data and reports. The Science and Technology Observatory is an analytical-evaluation database system and knowledge base which contains in a homogenous structure all the relevant information from the field of RTDI – in particular about the RTDI tenders – to facilitate networking and the evidence-based decision-making. The Observatory takes part in the development and researches of the international statistics and creates an information system which provides adequate knowledge to understand the trends.

Innovation policy is pursued in a broad sense going beyond technological research and its applications. (IU SAT, item 3) In the past few years, several schemes, co-funded by the EU Structural Funds, have been introduced to promote improvements of processes and organisational change, introduction of new business models, and marketing. In relation to this item, it should be mentioned the specific call of the Societal Renewal Operation Programme (TÁMOP 4.2.3 in 2009) that especially targeted knowledge dissemination activities of universities and research institutes and has been re-launched in 2012.

Supply-side policies and measures dominate in the Hungarian RTDI policy mix. The National Innovation Office launched a pilot programme to elaborate a pre-commercial procurement (PcP) strategy in 2012. Also, the draft innovation strategy has a specific measure that foresees support of open, pre-competitive and social innovation collaborations. (NRDIS, 2012, p. 38)

Adequate and predictable public investment in research and innovation focused in particular on stimulating private investment. (IU SAT, item 4) The most important domestic fund (KTIA Fund), earmarked to support RTDI activities, was frozen in 2010, practically no new commitments were allowed to make in 2011. Then new calls were launched in 2012 that specifically target the stimulation of private investments.

R&D tax incentives have more than a decade long history in Hungary. Since 2001, companies are allowed to deduct 200% of their R&D expenses from their taxable income. This option could also be used for R&D activities commissioned from public or non-profit research organisations. Companies can claim a 300% tax allowance if its R&D unit is located at the site of a university or public research institute. From January 2013, the employment of researchers with a PhD title (up to salaries of ~ €1,800 / month) became cheaper as companies are exempt to pay social security contributions and other contributions (altogether 27% less). This incentive makes cheaper the employment of about 1,300 researchers currently working for companies and makes attractive of employment of new researchers.

Building high quality knowledge infrastructure and developing links to the industry has been a priority with regards to development projects implemented by Hungarian universities and research institutes. Between 2009 and 2010, about €500 million was invested from the various operational programmes of the Structural Funds in university research infrastructure. The order of magnitude of this investment has been about double of the HERD in respective years. Also, the share of support provided from the Structural Funds for SMEs grow from 16% to 68% between 2005 and 2009. (MTA 2011) In this regard, it should also be mentioned that the government would commit 60% of the funds for economic development purposes in the next programming period of the Structural Funds according to its resolution published in December 2012 as presented in Section 2.4.

Excellence is a criterion for research and education policy. (IS SAT item 5) Research funding is increasingly allocated on a competitive basis that has a consequence that excellent research

centres that are not prepared for participating in public calls feel a diminishing support for their RTDI activities. In the past few years, smaller higher education and research organisations became the beneficiaries of increasing share of competitive funding while large, traditional universities miss previous amount of institutional funding diminished after the reduction of state funding for social science specializations. Also, the largest PRO network, the Hungarian Academy of Sciences is in the process of rationalization its operations. (see Section 2.5 for further details)

Education and training system provide the right mix of skills. (IS SAT item 6) The future of R&D and innovation activities is predetermined by the quality and quantity of scientists and engineers, and the level of skills more generally. Yet, both the share of S&E graduates and the rate of participation in life-long learning are rather low in Hungary in international comparison. A significant gap might be opening between the supply and demand for qualified science and engineering (S&E) personnel in the near future.

Partnerships between higher education institutes, research centres and businesses are actively promoted. (IU SAT, item 7) There have been no major changes in terms of the main target groups of STI policy measures over the past few years. Some schemes provide support for individual firms, while others put the emphasis on industry-academia co-operation or setting up accredited innovation clusters, and innovation activities by the members of these clusters. However, the result and impact of these measures have not made a breakthrough in the low occurrence of co-operation in innovation activities among business and academic actors. A promising initiative has been the establishment of *regional university knowledge centres*, nevertheless the expectation of self-sustaining of these centres within 3 years after establishment seemed unrealistic as most of these centres are starving for new funding nowadays.

Framework conditions to promote business investment in R&D, entrepreneurship and innovation. (IU SAT, item 8) Macroeconomic policies have failed to create a stable, predictable environment for businesses. Economic growth has been volatile at least since the mid-1990s, due to the stop-go type policies to a large extent. Inflation has constantly been above the target, and thus making business planning a more demanding task. Government behaviour has also been unpredictable (e.g. the tax code has been rewritten frequently). The Hungarian competition and IPR rules are in accordance with the EU legislation and international treaties. (OECD, 2008) It seems, however, that regulation is a necessary but not sufficient condition for an intense market competition, inducing innovation. Most firms do not feel the pressure to innovate. (Havas, 2012)

Public support to research and innovation in businesses is simple, easy to access and high quality. (IU SAT, item 9) The Hungarian policy mix has a disproportionally high number of measures. As reported earlier, there is a shift towards increase SMEs' participation in support programmes, however calls frequently overlap, manuals are often incomplete and require unnecessary conditions to be fulfilled by the applicants, and therefore many companies are just not interested in participating. Apart from this, SMEs often lack both the capacities and capabilities to participate in public calls.

Evaluation and international peer review is not frequently used in national funding. One of the exceptions is the Momentum programme of the Hungarian Academy of Sciences that aims at the renewal of the research teams of the Academy and participating universities via attracting outstanding young researchers back to Hungary. The impact and success of this application model is highly acclaimed and recognised even by the international scientific community whose members participate in the selection board.

The public sector itself as a driver of innovation. (IU SAT, item 10) Measures are in a preparatory phase both at a regional and national level to introduce pre-commercial procurement as a policy tool.

The Public Procurement Council considers this issue as a priority, and aims at disseminating relevant information among stakeholders. Further, the Science and Innovation Programme of the New Széchenyi Plan highlights pre-commercial procurement among the priorities, with proposed actions including: (i) dissemination the culture of pre-commercial procurement, and (ii) application of pre-commercial procurement in tendering in order to enhance developments in the ICT sector. (Havas, 2012)

4.3 Assessment of the policy mix[16]

The overall paradoxical feature of the Hungarian NIS is that innovation performance is 'moderate' (IUS, 2011) in spite of an impressive number and range of STI policy measures, which seem to be appropriate. Further, there are 'recurring' severe macroeconomic imbalances, too, at least for years, if not decades. In such an uncertain environment firms tend to focus on day-to-day survival, and thus RTDI activities are rarely in the focus of business strategies.

As to the individual challenges highlighted in Section 3 of this report, at least the first three of them have been identified in various policy documents by the government, while the other two ones by independent experts and international organisations. None of them are recently identified challenges, and hence several measures have been introduced to promote RTDI activities of firms, strengthen industry-academia co-operation, and increase the supply of S&E graduates. In brief, somewhat modest improvement has been achieved in these three fields, and hence STI policy measures have not been highly effective.

In terms of RTDI figures, the **share of innovative firms** has not increased – at least not up to 2008, i.e. the latest available CIS results. The BERD/GDP ratio, however, has escalated from 0.36% in 2004 to 0.75% by 2011, but still lagging considerably behind the EU-27 average (1.26%). From a different angle, it is not only way below the Barcelona target reinforced by the Europe 2020 strategy, but also the government's own target of 0.9% of GDP to be reached by 2013 (according to the mid-term STI policy strategy).

Private research efforts are conducted to a disproportionately large extent by large, mainly foreign-owned firms in a handful of sectors. Large firms with more than 500 employees accounted for 52.6% of BERD in 2011. Their weight had been even higher between 70% and 80% in 2000-2007. While the share of research units operated at foreign-owned businesses remained below 15%, these firms accounted for 66-74% of BERD in 2003-2007, decreased to 62.9% in 2011. Compared to 2010, domestic firms increased their R&D expenditures in 2011 by 15.7%, their fully foreign owned counterparts by 22.3% Notably, the manufacture of pharmaceuticals, medicinal chemicals and botanical products accounted for 58.0% of the total R&D spending in manufacturing industry in 2006 (Eurostat), and still 42.5% in 2011. (KSH) That implies that RTDI strategies of the parent companies of these subsidiaries are at least as important as Hungarian STI policies.

As for **industry-academia co-operation**, mixed assessments are offered by evaluation reports. One Innovation Union Scoreboard indicator shows some improvement: the number of public-private co-publications per million inhabitants has increased from 15.5 in 2003 to 19.6 in 2008, but it is still 54% of the EU average.

With regard to **human resources** for R&D and innovation, although several indicators have shown improvement, Hungary is still way below the EU-27 average. Unfortunately, the

[16] This Section of the report substantially builds upon Havas (2010) and Havas (2012).

'desirable' ratio of S&E students cannot be achieved in the short-run although the government tries favouring and pushing students towards S&E specializations with its initiatives in 2012. Still students find law and business studies more attractive than S&E fields even if state funding is basically available for these types of studies and other students should pay partly or fully the cost of their education.

Framework conditions for innovation have not improved, as already stressed in Section 3.

Deficiencies in the STI governance system and the institutional framework. For many years, innovation has not been a major policy issue hence the *lack of political commitment* is a major problem in Hungary. Politicians' agenda has been almost permanently preoccupied with short-term macroeconomic tensions, the complex challenges of the transition process in the 1990s, and then joining the European Union, as well as domestic political issues. Further, RTDI is still mainly perceived as burden on the budget, rather than part of the solution, i.e. a major factor to socio-economic development. Thus, the potential – and obviously long-term – contribution of innovation to socio-economic development is not in the centre of political and policy discussions in Hungary: STI policies are eclipsed by the immediate political and economic policy goals.

The last two years have only strengthened this feature. STI policies received hardly any attention from politicians in 2010, given the two elections held in the same year (general elections in April, followed by local elections in October). Hence, no STI policy changes occurred. Given the cuts in domestic public funding for RTDI since June 2010, already mentioned, several small companies and bridging organisations, for which revenues from government support schemes are crucial sources, already face severe financial difficulties, and major decision-preparatory projects, e.g. the one to underpin the national RI development strategy, have also been put on halt. More generally, these abrupt measures undermine the shaky relationship between the research community, firms active in RTDI, and politicians.

As for *instability*, frequent reorganisations of the STI policy governance sub-system have become a major feature of the Hungarian NIS. Several studies have noted that organisational instability affects negatively policy formation and implementation as it hampers organisational learning and imposes unnecessary burdens on RTDI performers, too. (Ernst & Young and GKI, 2010, Havas and Nyiri (eds), 2007, OECD, 2008)

Apart from instability of national level organisations, the future is also uncertain for those at the *regional level*. The Regional, County and District Development Councils were dissolved with effect of 31 December 2011. (Act CXCVIII of 2011) Their tasks are to be performed by county-level authorities. The seven Regional Development Agencies were nationalised by the same law. The Regional Innovation Agencies (established in 2005 then restructured in 2008) used to co-operate closely with the Regional Development Councils. Their future operation has become uncertain, as they don't get any institutional funding. The survival of these agencies mainly depends on their ability to raise revenues via providing various advisory and consultancy services (e.g. in the field of innovation management and project proposal writing) or applying support from domestic and EU funds.

As indicated in Section 3, the *draft innovation strategy* (published in November 2012) also reflects some uncertainties concerning the implementation structures of the strategy. Apart from lacking of clearly indicated responsibilities, the main issue is that government bodies responsible for policy design and policy implementation have no critical mass capacities and professionals. The same is true for intermediary organisations, including regional level ones, and particularly the regional innovation agencies. In this respect no short term improvement could be forecasted.

Finally, *policy learning processes* were described by the OECD Review as slow and insufficiently informed. "Tools for strategic policy intelligence and policy learning, such as monitoring, evaluation, and technology foresight, are used only occasionally (…)." (OECD, 2008, p.16) This list can be extended by the lack of thorough analyses of innovation performance (combining census, R&D and innovation data) and technology assessment. The government's STI policy action plan also stipulates that it is an important task to apply relevant, up-to-date methods – notably technology foresight, technology assessment and technology watch – to identify, co-ordinate and channel demands for knowledge. However, the prevailing practice is one of fragmented support for RTDI activities, without a comprehensive understanding of knowledge dynamics (drivers for the emergence of new knowledge, and demand for knowledge).

Table 1: Structural challenges, policy actions, and impacts, Hungary

Challenges	Policy measures/ actions	Assessment in terms of appropriateness, efficiency and effectiveness
Low level of innovation activities, especially that of the SMEs	A large number of schemes and increased public funding are in place providing incentives for companies to engage in RTDI.	These measures are appropriate, e.g. in terms of their overall objective, the identified target groups, and the tools applied (grants and tax incentives). Yet, they are not likely to be effective unless framework conditions for RTDI improve significantly.
Low occurrence of co-operation in innovation activities among key actors	Several schemes have provided incentives for strengthening industry-academia co-operation since the late 1990s.	In general, these schemes are appropriate; there is a strong rationale to use public funding for this purpose. Public funds are not spent as efficiently as it could be: (i) several of these measures have overlapped; (ii) these measures might have induced 'rent-seeking' strategies, leading to superficial and temporary collaboration, instead of facilitating knowledge circulation and exploitation in a sustained way. Evidence on impacts is mixed. The effectiveness of these measures could be significantly increased by reforming the public research sector, especially placing more emphasis on exploitability of knowledge when evaluating research performance.
Potential gaps in the quantity and quality of human resources for RTDI	The quota for publicly financed students enrolled at S&E faculties has been increased.	Financial incentives or mechanical increases in S&E enrolment themselves might not yield results without major changes in the research and education systems, and sustained, concerted public efforts and actions by businesses.
Unfavourable framework conditions for innovation	The economic policies pursued since June 2010 have increased fiscal tensions by the end of 2011.	Given the macroeconomic tensions and the lack of meaningful dialogue among the major political parties it is uncertain if fundamental reforms, needed to create more favourable framework conditions, can be implemented. The economic structure is dominated by large multinational companies that outperform their domestic counterparts in RTDI, but don't create enough demand for innovative SMEs and public research centres. The overall entrepreneurship culture is underdeveloped, neither high technology entrepreneurship nor start-up is popular among (young) scientists. These issues together with the intensity and type of competition seem to influence firms' behaviour with such a power that STI policy schemes cannot offer strong enough incentives to overrule these unfavourable effects.

Challenges	Policy measures/ actions	Assessment in terms of appropriateness, efficiency and effectiveness
Deficiencies in the STI governance system and the institutional framework	The STI policy governance system was reorganised in 2010, then once again in 2012. Regional level organisations and intermediaries have uncertain future, they struggle for survival.	No measures have been taken to rectify the shortcomings identified by the OECD Review. The reorganisation of the policy governance sub-system has further aggravated the problems stemming from instability: (i) lack of organisational capacities possibility for organisational learning and thus weakened policy formation and implementation capabilities; (ii) unnecessary burdens on RTDI performers.

Source: based on Havas (2012)

5 NATIONAL POLICY AND THE EUROPEAN PERSPECTIVE

Concerning the alignment of the national policy mix with the ERA Communication, the following short analysis is provided according to the five priorities set by the communication. (ERA, 2012)

1. More effective national research systems – *including increased competition within national borders and sustained or greater investment in research.*

The restructuring of the Hungarian Academy of Sciences (MTA), the largest PRO network in Hungary, aims at increasing of the effectiveness of financing the public duties of the research network. The first out of the three phases of the renewal process resulted in the establishment of the new structure by the end of December 2011. As of 1st January 2012, the number of research centres and institutes of MTA has been reduced to 10 and 5, respectively.. The next phases of the renewal of MTA will see structural changes and "disciplinary fine-tuning". During this phase, the renewed research centres and institutes will be developing their own strategies, while strengthening the infrastructure of the entire institute network. The main theme of the third phase of the programme is the renewal of the research funding system. A tighter co-operation between the research networks of the Academy and those of the universities is to be achieved by eliminating administrative obstacles, increasing the effectiveness of MTA research teams, and by establishing a common infrastructural development.[17]

The most important aspect of the renewal process aiming to increase competitiveness is that research teams assembled by outstanding and talented researchers will play a key role in this new system, based on funding individual excellence. Another important aspect of the renewal is that, following the harmonisation of directions of a strategic development, the attainment of performance goals of the institutes can be judged by international bodies. By creating the right conditions for attracting the resources needed, a unique opportunity opens up for creating a balance between public research funding and application based funding. The HUF 7.7 billion (~ €27.5 m) allocated for MTA of the budgetary proposal of 2012 serves the purpose of increasing competitiveness and enables research centres to participate in European research projects with an increased funding from 2014 more effectively than previously.

[17] see http://mta.hu/news_and_views/has-network-of-institutes-up-for-renewal-128954/

2. Optimal transnational co-operation and competition *- defining and implementing common research agendas on grand-challenges, raising quality through Europe-wide open competition, and constructing and running effectively key research infrastructures on a pan-European basis.*

The role of innovation in addressing societal challenges, and social innovation are generally perceived as not important issues in Hungary. Nevertheless, a horizontal priority of the recently published draft innovation strategy foresees a measure that specifically aims at supporting of research related to global grand societal challenges. The priority fields are related to research of water resources, agri-food production, energy research, brain research, integration of roma population and network research (mathematics). (NRDIS, 2012, p. 66)

So far Hungary has chosen to participate in two research infrastructures (RI) listed on the ESFRI roadmap: XFEL with 1% of the total budget, around €1.0-1.5 m in the construction phase; ELI with around €3.5 m allocated for the preparatory phase to host one ELI site in Hungary. Besides, several Hungarian research units have expressed their interest to participate in over a dozen ESFRI projects, in which cases RIs are (or would be) located in other EU countries. Hungary has joined several inter-governmental agreements, organisations and large RIs, nevertheless there is not much funding allocated for those collaborations. Various calls were launched (in total of €19.6 m) in 2012 to support EIT KIC, EUREKA, bilateral STI collaborations. Given the size and level of economic development of the country, not much funding is available to invest in expensive research infrastructure, roughly €100 m a year. Only a small fraction of the Hungarian RIs can be regarded as large RIs, mainly in physics. The best known example is the research reactor operated by the Atomic Energy Research Institute (MTA), open to the international research community. (Havas, 2012)

Furthermore, an intergovernmental committee was set up in 2012, headed with the president of the Hungarian Academy of Sciences, to set priorities for the Hungarian participation in strategic research infrastructures and match research and professional demand with financial reality. (NRDIS, 2012, p. 65)

3. An open labour market for researchers *- to ensure the removal of barriers to researcher mobility, training and attractive careers.*

In general, research positions at public research institutes are open to non-nationals. In most cases, however, command of the Hungarian language is among the prerequisites. That basically prevents foreign nationals from applying for these positions (except the ethnic Hungarians coming from neighbouring countries).

The equivalence/ validation of foreign academic degrees, i.e. the recognition of foreign certificates and degrees are carried out by the Hungarian Equivalence and Information Centre (Hungarian ENIC, a member of the European Network of Information Centres) within the Educational Authority, while the nostrification of scientific degrees is done by the Hungarian higher education organisations. The only exception is the recognition of the foreign Candidate of Science and Doctor of Science degrees under international agreements.

Just as in other new EU Member States, Hungarian research institutes advertise very few (a mere 10 in March 2013) vacancies (for researcher positions) on the Euraxess website. The Hungarian Rectors Conference called the attention of the rectors in January 2013 to join to the Code of Conduct for the Recruitment of Researchers that aims to improve recruitment, to make selection procedures fairer and more transparent and proposes different means of judging merit. Grants awarded by the various Hungarian research funding schemes are generally not transferable to other (national and foreign) research institutes. (Havas, 2012)

4. Gender equality and gender mainstreaming in research – *to end the waste of talent which we cannot afford and to diversify views and approaches in research and foster excellence.*

Rules changed significantly in the new Labour Code in effect from 1 July 2012. The restoration of the same position after maternity leave is no longer safeguarded by the general provisions of the Labour Code. The employer can quit the employee in case the previous position terminated, the employer cannot offer similar position to the person coming back from maternity leave and the person rejects the offered new position. At the same time, the employer is not obliged to extend the employment period of a fixed-term contract.

There are no specific provisions for female researchers. Gender quotas have been discussed in various areas in order to reduce the gap between the representation of men and women in various professions and bodies, but have not been introduced. According to the Eurostat, 41% of managerial positions are filled in by women in Hungary, although survey data reveals that their real share is lower, about 18 % reported by the Hay Group. The share of female researchers is 40,1%, although their share is much lower (25.7%) in R&D positions at companies. (KSH, 2012)

5. Optimal circulation, access to and transfer of scientific knowledge including via digital ERA - *to guarantee access to and uptake of knowledge by all.*

Hungarian researchers intend to contribute to the development of a sustainable, efficient, and effective European scientific information system via ESFRI initiatives (developing e-infrastructures in all various fields of science). Support to these efforts at this stage – until a national RI development strategy is completed – can only be obtained via one-off decisions, i.e. not in the framework of a dedicated scheme.

There are no specific Hungarian policy measures aimed at enhancing open circulation of knowledge across national borders and open access to research outputs (publications and data) by researchers and society at large. (Havas, 2012)

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LIST OF ABBREVIATIONS

BERD	Business Expenditures for Research and Development
BME	Budapest University of Technology and Economics
CERN	European Organisation for Nuclear Research
CIS	Community Innovation Survey
COST	European Cooperation in Science and Technology
CSR	Country Specific Recommendation
EDOP	Economic Development Operational Programme
EIS	European Innovation Scoreboard
ELTE	Eötvös Lóránd University of Sciences
ERA	European Research Area
ERA-NET	European Research Area Network
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
FP7	7th Framework Programme
FTE	Full-time equivalent
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HERD	Higher Education Expenditure on R&D
HES	Higher Education Sector
HUF	Hungarian Forint
IP	Intellectual Property
IU SAT	Innovation Union self-assessment tool
JTI	Joint Technology Initiative
KSH	Hungarian Central Statistical Office
KTIA	Research and Technological Innovation Fund
MISZ	Hungarian Association of Innovation
MTA	Hungarian Academy of Sciences
NEFMI	Ministry of National Resources
NEKIFUT	National Research Infrastructure Survey and Roadmap
NFK	National Development Cabinet
NIH	National Innovation Office
NIS	National Innovation System
NKITT	National Research, Innovation and Science Policy Council
NKTH	National Office for Research and Technology
NRDIS	National Research and Development and Innovation Strategy
NRP	National Reform Programme
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
OP	Operational Programme
OTKA	National Scientific Research Fund
PcP	Pre-commercial Procurement
PCT	Patent Cooperation Treaty
PPS	Purchasing Power Standard

PRO	Public Research Organisation
R&D	Research and Development
R&D&I	Research and Development and Innovation
RI	Research Infrastructure
RIÜ	Regional Innovation Agency
RTDI	Research Technological Development and Innovation
S&E	Science and Engineering
S&T	Science and Technology
SF	Structural Funds
SIP	Science - Innovation Programme
SME	Small and Medium Sized Enterprise
SZTE	University of Szeged
SZTNH	Hungarian Intellectual Property Office
STI	Science, Technology and Innovation
TTPK	Science and Technology Policy Council
VC	Venture Capital