# Innovation Policies in the Visegrad Countries


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Visegrad innovate

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## Abstract

This report first reviews the current discussion about innovation, looking at its definition and theoretical underpinnings from different angles. It is followed by an analysis of the rationale, goals, instruments and organisational framework of innovation policies in the Visegrad Countries. The report argues that the Visegrad Countries tend to focus on a narrow understanding of innovation – expressed in the science-push model of innovation, as well as in mainstream economics – as opposed to the broader understanding promoted by the evolutionary approach. The latter approach would provide more appropriate guidelines for developing innovation systems, improving performance and achieving more pronounced and favourable impacts on socio-economic development in general.

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# 1 What is innovation and how to measure it?

## 1.1 Studies on innovation from different perspectives

Innovation was a major theme in classical economics. Upon the advent of neoclassical economics (general equilibrium theory), however, research questions concerning dynamics moved to the second plan and instead the focus was shifted to static comparative analyses and optimisation. Technological change was treated as exogenous to the economic system. Given the compelling empirical findings and new theoretical insights about company behaviour and the operation of markets, various branches of mainstream economics have recently paid increasing attention to innovation. Other schools of economics, in particular the evolutionary economics of innovation, have focused their attention on various aspects of innovation, and to do so developed a new conceptual framework, challenging several of the axioms and fundamental notions of mainstream economics. (Nelson and Winter, 1982; Kline and Rosenberg; 1986)

The beginnings of contemporary studies into innovation were rooted in questions related to factors influencing economic cycles. In contrast to other economists of that time, who focused on the accumulation of capital or stimulating supply as the sources of economic growth, Schumpeter (1942) underlined the significance of revolutionary changes in businesses, institutions and technologies.

Further major results of evolutionary and institutional economics include the development and fruitful application of the systems of innovation approach, differentiating between national and subsequently technological, sectoral and regional innovation systems (Freeman, 1987; Lundvall, 1988; Carlsson, 1991; Malerba 2002; Cooke, Uranga, Etxebarria, 1998). Thanks to the studies on technical paradigms, technical change and technological trajectories (Dosi, 1982; Pavitt, 1984), a complex explanation of the role of innovation in the economy, of how and when innovations emerge was developed.

Although economics is probably the most “productive” discipline for contemporary studies of innovation, this topic has also been of interest to many other disciplines. Besides economics, economic history and geography, other disciplines that have contributed the most to the study of innovation are engineering, management, and sociology. (Fagerberg & Verspagen, 2008)

The neo-Schumpeterian school contributed to an understanding about the links between technological, economic, organisational, institutional and societal changes. The topic of innovation sparked the development of new branches of studies that integrated different disciplines. Science, technology and social studies or, as it is has been called more recently, science and technology studies (STS), collect and combine knowledge from various disciplines like social, cultural and political studies.

Of the most prominent STS theories (schools), one should mention the social construction of technology (SCOT), sociology of scientific knowledge (SSK) and actor-network theory (ANT). These theories discuss the role of social actors and factors in the acceptance or denial of scientific and technological changes.

Thanks to the deeper and broader studies on innovation it has become clear that given its multi-dimensional and dynamic nature a thorough analysis of innovation should draw on the results and methods of various scientific disciplines.

## 1.2 Defining innovation

Based on various studies and consent between scientists, the Eurostat and the OECD have developed a joint definition of innovation. The definition – its most recent version is presented in the 3rd edition of the Oslo Manual (2005) – has become widely accepted among policy-makers and analysts.

| **Definition of innovation (OECD, 2005):** |
| --- |
| **The implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practice, the workplace organisation or external relations.** |

This definition has two fundamental distinctions:

- between invention and innovation, whereby the latter represents inventions successfully introduced to the market, and
- between technological innovations, namely products and processes, and non-technological innovations, i.e. organisational and marketing methods.

The Oslo Manual underlines the importance of both radical and incremental innovations. It also emphasises that innovation can be seen at three levels – at company, market or global level.

The on-going discussion on the notion of innovation stresses that the Oslo definition does not take into account the wider dimensions of innovations. Thus several new types and areas of innovation have gained more attention from scientific communities, of which the following three seem to be fairly important: consumer (user) innovations, social innovations and innovations in the public sector.

The OECD itself points out that there are fundamental changes in the way in which innovations are created: more mechanisms are applied to create innovations and more people are participating in this process, teams of innovators are more flexible and their structures are taking new forms. (OECD, 2009)

Moreover, the market is no longer the only or the ultimate environment for innovations. It is the needs of society that stimulate the innovativeness and conversely, social innovations that enhance society's capacity to act.

Public sector innovations are particularly important. The quality of governance directly and indirectly influences the ability to innovate. This relates to the quality of the overall innovation eco-system but is particularly important for innovation policy. The wider understanding of innovation also requires new instruments to stimulate it. Furthermore, public sector innovations determine the quality of fundamental services, and how effectively public money is spent on these services, e.g. health, education and defence.

It is too early to assess the way in which the new knowledge could refine the OECD definition of innovation. However, the third revision of the Oslo Manual is already planned to start in 2015, and a year later an influential Blue Sky III conference will look at the issues related to assessment in view of making further improvements to the innovation studies. (Gault, 2014)

## 1.3 International indices of innovativeness

The wide recognition of the importance of innovation to development has led different kinds of organisations to create measures that allow assessing innovation performance. The widest scope of measures is related to the economic dimension of innovation. These measurement tools differ from one another regarding the definition of innovation, the subject of assessment (firms, sectors, regions or countries), the data they are based on (qualitative and quantitative) and the methodology used to collect the data and assess innovativeness. These indices allow monitoring the impact of policies and their comparison. From the V4 perspective there are three sources of information about innovativeness that seem to be particularly interesting.

The *Innovation Union Scoreboard* provides a complex image of innovation performance based on a large quantity of data, gathered in accordance with a standardised methodology. It allows different EU member states, regions and sectors to be compared and provides useful information to assess the impact of EU and national innovation policies.

The *Global Innovation Index* offers a broader perspective (in line with its name), which is crucial for the globalised world. Due to the lower amount of comparable data, it offers less insightful knowledge about different countries.

The *Global Competitiveness Index*, published by the World Economic Forum (for a decade now), provides important information about the economic performance of countries around the world. It supplements information available from other sources and helps understand the situation of developing countries, identify the drivers of their productivity and prosperity, and estimate their prospects for becoming an innovation-based economy.

Table 1. Position of the Visegrad countries in selected international rankings

| | Czech Republic | Hungary | Poland | Slovakia | Out of: |
|---|---|---|---|---|---|
| Knowledge Economy Index[1] | 26 | 27 | 38 | 33 | 144 |
| Global Innovation Index (INSEAD)[2] | 28 | 31 | 49 | 36 | 142 |
| International Innovation Index[3] | 32 | 31 | 52 | 36 | 110 |
| Global Creativity Index[4] | 29 | 26 | 41 | 41 | 82 |
| Innovation Union Scoreboard[5] | 19 | 24 | 29 | 25 | 34 |
| Bloomberg Innovation Quotient[6] | 23 | 26 | 24 | 46 | 110 |
| Global Competitiveness Index[7] | 46 | 63 | 42 | 78 | 148 |

In the main international innovation rankings, the Visegrad Countries remain below the EU-average level. Four out of seven indices rank the Czech Republic as the leader among the V4. Hungary at the second position is still clearly ahead of Slovakia. Poland remains at the bottom of the group with the only exception of competitiveness ranking listing it as the leader among the V4.

[1] http://info.worldbank.org/etools/kam2/KAM_page5.asp, 2012, weighted by population.
[2] http://www.globalinnovationindex.org/content.aspx?page=data-analysis, 2013.
[3] http://www.themanufacturinginstitute.org/~/media/6731673D21A64259B081AC8E083AE091.ashx, 2009.
[4] http://martinprosperity.org/media/GCI%20Report%20Sep%202011.pdf, 2010.
[5] http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014_en.pdf, 2014.
[6] http://images.businessweek.com/bloomberg/pdfs/most_innovative_countries_2014_011714.pdf, 2014.
[7] http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/, 2013-2014.

## 1.4 What is measured and what should be measured in the view of the V4

The standard indicators of the innovation systems referred to in public debates usually concentrate on the distinction between inputs and outputs. Thus the most common question being asked is *how much is invested* and *how much is produced*. However, for the sake of the development of a particular innovation system the more important question about innovations is *how they are produced*.

An important critical comment concerning the Innovation Union Scoreboard – the main tool of assessment – is that it largely follows the science-push model, in which innovations stem from codified scientific and technical knowledge. In this STI logic, government policies should focus on supporting R&D activities. The evolutionary approach underlines the importance of other types, forms and sources of knowledge for innovation. It identifies another major mode of innovation – *Doing, Using and Interacting* (DUI) –, in which informal processes of learning and experience-based knowledge play a crucial role (Jensen et al., 2007; Aslesen et al., 2012; Chen et al., 2011).

Critics pointing at the need to monitor both the STI and DUI modes have influenced the transformation of the Innovation Union Scoreboard (previously the European Innovation Index). Nevertheless, after three major modifications of the IUS, 14 out of 24 indicators exclusively or mainly deal with R&D-based innovations, a further six indicators can be assessed as relevant for both types of innovations and only four focus on non-R&D-based innovations (Havas, 2014a).

The clear implication of the systemic view is that – given the diversity between innovation systems (in this case: national innovation systems) – one should be very careful when trying to draw policy lessons from the 'rank' of a country based on a composite indicator. A scoreboard can only be constructed by using the same set of indicators across all countries, and by applying an identical method to calculate the composite index. Despite this, analysts and policy-makers need to realise that any poor performance signalled by certain indicators, therefore leading to a low ranking on the scoreboard, does not automatically identify the area(s) which require(s) the most urgent policy action. For example, in the event that several indicators are used to measure "high-tech" performance, for a country at a lower level of economic development it might be more relevant to focus scarce public resources on improving the conditions for knowledge dissemination and exploitation, rather than spending money on creating scientific knowledge. This is a gross oversimplification, of course, which is far removed from the level of detail required for any policy recommendation and is merely meant to underline that devising policies based on the innovation systems approach is a demanding task.

As a consequence, the Visegrad countries need to avoid the trap of paying attention to simplified rankings. Instead, it is of utmost importance to conduct detailed, thorough comparative analyses, identifying the reasons for disappointing performances, as well as the sources of balanced, sustainable socio-economic development (Havas, 2014b).

# 2 Innovation policy rationales

## 2.1 Economic theories of innovation policy

Economic theories offer two different policy rationales as to why R&D and innovation should be supported by public policies. Mainstream economics is primarily concerned with *market failures*: the unpredictability of knowledge outputs from inputs, the inappropriability of the full economic benefits of private investment in knowledge creation and the indivisibility of knowledge production lead to 'less than optimum' R&D efforts by companies. Political interventions are therefore justified if they aim at (a) creating incentives to boost private R&D expenditure by way of subsidies and protecting intellectual property rights, or (b) funding for public R&D activities.

Evolutionary economics of innovation investigates the role that knowledge creation and exploitation play in economic processes; i.e. this school does not focus exclusively on R&D. It identifies various types and forms of knowledge, including practical knowledge – experience-based know-how – acquired via learning by doing, using and interacting. In other words, scientific knowledge is far from being the only type of knowledge required for the successful introduction of new products, processes or services, let alone non-technological innovations. This is not to deny that R&D is one of the vital sources of knowledge. It should be stressed, however, that besides in-house R&D efforts, the results of other R&D projects are also widely utilised during the innovation process: extramural projects conducted in the same sector or in other sectors, at public or private research establishments, home or abroad. More importantly, there are a number of other sources of knowledge, which are also essential for innovations. These include designing, scaling up, testing, tooling-up, trouble-shooting and other engineering activities; ideas from suppliers, users and NGOs (e.g. patient groups and environmental activists), inventors' ideas and practical experiments (Hirsch-Kreinsen *et al*. (eds), 2005; Klevorick *et al*., 1995; Lundvall (ed.), 1992; Lundvall, Borrás, 1999; von Hippel, 1988). The evolutionary economics of innovation posits that the success of companies is largely determined by their ability to exploit various types of knowledge, generated by both R&D and non-R&D activities. Knowledge generation and exploitation takes place in, and is fostered by, various forms of internal and external interactions. The quality and frequency of the latter is largely determined by the properties of the respective innovation system, in which these interactions take place. STI policies, therefore, should aim at strengthening the respective innovation system and improving its performance by tackling *systemic failures* that hamper the generation, diffusion and utilisation of any type of knowledge required for successful innovation.

Table 2. Characteristics of the neoclassical and systems of innovation approaches and the policy implications of these approaches

| | Neoclassical | Systems of Innovation |
|---|---|---|
| **Underlying assumption** | Equilibrium<br>Perfect information | Non-equilibrium<br>Asymmetric information |
| **Focus** | Allocation of resources for invention<br>Individuals | Interactions in innovation processes<br>Networks and framework conditions |

| **Main policy** | R&D policy | Innovation policy |
|---|---|---|
| **Main rationale** | Market failure | Systemic problems |
| **Government intervention (examples)** | Provide public goods<br>Mitigate externalities<br>Reduce barriers to entry<br>Eliminate inefficient market structures | Solve problems in the system<br>Induce changes in the supporting structure for innovation<br>Support the creation and development of institutions and organisations and support networking<br>Facilitate transition and avoid lock-ins |

Source: Chaminade, Edquist, 2006

Quantitative indicators are widely used to monitor the implementation of STI policies and assess their impact, often in comparative analyses. It is crucial, therefore, what types of indicators are chosen: those that are appropriate to measure innovation processes posited by the science-push model (and adopted in the market failure approach), or those that are able to capture a broader understanding of innovation, exploiting various forms and types of knowledge, as described in the networked model of innovation (on which the systemic failures rationale is based).

Although evolutionary economics offers a more complex and deeper understanding of the nature of innovation processes, mainstream economics thanks to its simpler framework still dominates innovation policies in many countries. Furthermore, although the evolutionary paradigm provides a sounder underpinning for effective and appropriate innovation policy, its practical use heavily depends on the way of thinking (i.e. the educational background) of policy-makers: as most of them are trained as scientists or economists who have graduated from universities where only mainstream economics is taught, they tend to follow the science-push model of innovation and the market failure policy rationale, respectively.

## 2.2 STI policy rationales followed in the Visegrad countries

In the Czech Republic (CR), the comprehensive STI policy has a relatively recent history. Traditionally, this policy was purely science-driven and even during the transition to market economy in the 1990s was not associated with reflections about the importance of supporting innovation. Privatisation and foreign capital inflows were considered the most important factors of enhancing competitiveness, presuming that the market environment would quickly tackle the shortcomings of the Czech economy in terms of technology, productivity and innovation. Some projects and initiatives successfully managed to combine the R&D activities of the business sector with research organisations, and several science and technology parks were established with other organisations facilitating technology transfer. However, these measures were isolated and far from being complementary elements in a systemic approach. The old-fashioned model based on the exclusivity of science, separating the R&D results from practice as well as the dichotomy between the research community, on the one hand, and the performance of companies, on the other, continued.

Strategic documents in each of these “worlds” were written independently of each other, their implementation was separate and they only referred to each other declaratively. The CR’s competitiveness gap together with the influence of EU policies, the Europe 2020 Strategy and the Innovation Union in particular, made the Czech government focus on fostering innovation, strengthening the links between academia and businesses and use more domestic research results as resources for long-term economic growth.

In Hungarian STI policy documents the notion of market or systemic failures is rarely used. Furthermore, policy rationale is not specified explicitly in policy documents in any other way. It can be observed, however, that STI policy documents – and especially the way of thinking of high-level policy-makers – largely follow the science-push model of innovation. This model of innovation considers scientific knowledge to be the decisive input in the innovation processes. It neglects many other types and forms of knowledge, which are also vital for innovation activities, stemming from other sources and activities such as learning by doing, using, interacting and comparing, as mentioned above. It should also be noted, however, that some efforts to correct systemic failures, or from a different angle, to develop innovation systems at national, regional and sector level – can also be detected in various STI policy documents. Some experts – working in middle-level positions – are certainly familiar with the different approaches to innovation.

Economics suggests that activities with long-term returns require a stable, or at least predictable environment. Innovation and R&D are such activities: they increase in times of political, macroeconomic stability, stable finances and reliable, sustained external assistance. Indeed, robust output growth, stable inflation and low real interest rates are all found to be important drivers of innovation in a wide-ranging comparative analysis.

By contrast, Hungary has traditionally opted for a boom and bust policy since the 1970s, where the budget deficit would soar in 'good times' almost to crisis level, and was followed by a string of austerity measures. This general tendency for instability has prevailed until recently: a rising budget deficit led to a harsh austerity programmes , several changes to the taxation regulations and cuts in government spending. Whenever there was a need to reduce the budget deficit, public funds earmarked to support RTDI activities were among the first "victims" to go, most recently in 2010 and 2014.[8] That clearly suggests that STI policy is not perceived as a solution; but rather as a burden on the budget, and hence politicians and senior policy-makers are not engaged in serious, regular discussions as to which STI policy rationale is the most appropriate for Hungary.

The main Polish governmental STI policy strategies approach the topic comprehensively but do not refer directly to any school of economics. The main starting point for diagnosing the problem is of neoclassical nature, namely the weak incentives for R&D and the low availability of capital in the private sector. At the same time the weak interactions between these two sectors are well recognised and are often underlined as the main problem.

The weaknesses of the neoclassical model of innovation and in consequence the weaknesses of certain policy assumptions were reported by Polish researchers along with the development of relevant studies abroad. A need for reorientation of the R&D policy towards R&D and innovation (Geodecki, 2007) and creation of appropriate policies accommodating evolutionary perspective was formulated. Since then yet, no clear amplification of the concept was made. Also no operationalisation of the concept or planned reorientation of available instruments was proposed.

The main issue in public discourse and current governmental strategies goes beyond a theoretical approach to STI policy. Progressive argumentation underlines the risk of a "development drift" or middle-income trap. Both refer to the erosion of the foundations of Polish competitiveness, which is being undermined by increasing labour costs. The only chance to avoid these risks is to move from a reproductive model of the economy to a knowledge-intensive model where, due to a highly skilled workforce, companies are able to produce and sell more expensive goods and services in new markets.

[8] For example, in June 2010 the incoming government in Hungary suspended all disbursements from the Research and Technological Innovation Fund; furthermore, new project proposals were not accepted. The government decree stipulated that HUF16b (~€58.2m) had to be 'blocked', that is, 36.6% of the 2010 budget of the Research and Technological Innovation Fund. (government decree No. 1132/2010. (18 June)) Different forms of justification were given for this decision: (i) to check if previous funding decisions had been lawful; and (ii) to cut government spending. Similar decisions made in 2011 suggested that the latter was the real reason. Stakeholders – among others the Hungarian Association for Innovation and the Hungarian Biotechnology Association – heavily criticised this decision.

The concept of a middle-income trap (Eichengreen et al., 2012) is often quoted as an argument providing a scientific basis for further discussion. Although the necessity to avoid the trap is generally accepted, the speed and instruments of change remain controversial. The concept is also referred to by policy-makers but as it relates more to a long-term analysis, it is not easy to introduce this rationale to the actual policy agenda.

For many years, the support for science and technology in Slovakia has mainly focused on basic research in very broadly defined priority areas. Science push was a major driver of government strategy. It was believed that high investments in R&D will almost automatically lead to innovation. The role of universities and the Slovak Academy of Sciences in enhancing innovation and the economic performance of enterprises was strongly highlighted. Yet, the increase in public expenditures on R&D activities, mainly at universities and the Slovak Academy of Science did not lead to the desired results in economic growth. Broadly defined development priorities of science and technology have led to the inefficient use of scarce resources. The results obtained and the overall low level of co-operation has highlighted the inadequacy of the innovation model that focused mainly on market failures.

Since 2007 the Government of the Slovak Republic has approved a number of strategic documents focussing on science, research and development as well as technology and innovation. *The Innovation Strategy of the Slovak Republic for the period 2007 - 2013* and related innovation policies had potential to improve the National Innovation System and stimulate economic growth because of the complex approach focussing on R&D and innovation, however the potential has not been materialised. Documents mainly copied the approaches used in other countries and implemented the recommendations of EU bodies without a detailed assessment of their applicability to the Slovak Republic. In this strategy and related innovation policies we can see some measures that are focused on supporting not just research and development, but also other ways of generating knowledge (for example measures aimed at forming a system of life-long education), measures supporting interactions between innovators (for example regional innovation centres) and strengthening the innovation system (for example a project to establish a national information infrastructure), thus applying some of the principles of evolutionary economics of innovation. According to the document *Innovation Policy for the period 2011 to 2013*, it is necessary to gradually address the issues concerning the low level of private investment in science, research and innovation compared to advanced EU members, remedy the disproportions from the past when innovation development was mainly supported by EU Structural Funds or international co-operation programmes, improve co-operation between knowledge providers and beneficiaries across all industries, and for the public institutes to establish conditions to provide effective support to selected business entities engaged in industrial research and development.

However, the strategies do not take into account Foreign Direct Investment as a potential driver of R&D activities in the Slovak economy and do not reflect the needs of specific sectors. Documents were issued without clearly defined priority directions. These issues have been resolved by the newly approved *Smart Specialisation Strategy (RIS3)*, which is an *ex-ante* conditionality for the programming period 2014-2020. The Smart Specialisation Strategy is a breakthrough in terms of setting evaluation criteria for the measures. In case of the successful implementation of all its components, the lack of evaluation culture will also be resolved. RIS3 creates the preconditions for the sustainable growth of the competitive capability of Slovakia while also supporting the structural diversification of the economy.

# 3 Main STI policy goals

## 3.1 Czech Republic

The first *National Innovation Strategy* in 2004, following the CR's accession to the EU, represented a breakthrough compared to the traditional approach to innovation policy. It identified problems and outlined solution areas. Based on this analysis, it was concluded that the most persistent weaknesses of the CR in terms of the innovation system include the low focus of research efforts on excellence, the insufficient effectiveness of research activities, the low number of researchers and their low mobility, the under-usage of instruments to protect intellectual property, the fragmented public support for innovation and the limited use of research results in practice. With regards to the application of new knowledge, the following barriers have been identified: low demand for domestic R&D results and the services of both domestic and foreign companies, the lack of interaction and co-operation among the actors within the innovation system, the non-existence or poor quality of services relating to knowledge transfer, limited financial services focusing on innovative projects and the adverse tax and legislative environment for venture capital investments.

The next step was the adoption of a strategic document entitled *Back to the Top: The International Competitiveness Strategy for the Czech Republic 2012-2020*. The document included an updated version of the National Innovation Strategy of the Czech Republic, which was prepared in 2011 as a joint document by the Ministry of Education, Youth and Sports, responsible for education and research, and the Ministry of Industry and Trade, in charge of industrial and innovation policy. It declared an intention to comprehensively tackle the afore-mentioned issues and to implement, as in other developed countries, a second and third generation innovation policy which co-ordinates all the relevant policies and includes measures applied in different fields, i.e. in research, business, education as well as financial policy, especially taxation.

The Czech *National Policy for Research, Development and Innovations* for the period from 2009-2015 was adopted in 2009. It contained priorities in various areas including proposed measures with responsible bodies and the timeframe. In 2013 this policy document was updated to reflect new developments, especially the new European Union strategy initiatives (EU 2020 Strategy, Innovation Union), the impact of the financial crisis (especially on public finances), as well as relevant up-to-date national strategy papers and the recommendations of the international audit by the Czech RTDI system. In line with the EU 2020 strategy it also contains an outlook for 2020. The main goal of the updated policy is to provide high-quality conditions for creating new knowledge and its application to innovations in the business sector. It covers the relevant strategy documents of the Czech Republic and identifies several major goals:

1. Ensuring a research environment that produces internationally competitive results both in terms of quantity and quality by ensuring appropriate human resources are available for RTDI activities, developing an adequate and productive research infrastructure, increasing financial support from the state budget, enhancing the effectiveness of the public financing of RTDI activities, increasing the openness of research performers and improving international co-operation.
2. Increasing co-operation between public research, businesses and public administration to ensure effective knowledge diffusion and exploitation.
3. Increasing the innovation potential of the business sector, which will contribute to the competitiveness of the Czech economy by developing services for innovative enterprises, supporting innovation in enterprises and stimulating foreign investments in strategic research and innovation activities in the Czech Republic.

4. Developing a stable, effective and strategically managed national innovation system by increasing the efficiency of co-ordination within the policy governance sub-system and improving policy-making capacities, strengthening the strategic approach to the design and implementation of the STI policy, and enhancing the active participation of the Czech Republic in shaping the European Research Area.

Besides the strategy part of the paper where the above-mentioned priorities and goals are outlined, there is also an implementation part that proposes measures to achieve these goals, including indicators, timing and the responsible bodies. The proposed system of indicators is a step forward as previously it had been difficult to monitor the implementation due to a lack of relevant indicators.

The National R&D&I Policy, the first part of which is dedicated to R&D support, implicitly follows the principles and priorities formulated in the *National Priorities of Oriented Research, Experimental Development and Innovations* adopted by the government in 2012. It was a reaction to the previous over-prioritisation of goals which had been taken equally from all the major strategy areas. They were chosen regardless of whether it was an issue that was both socially desirable and utilisable or whether the Czech Republic had the necessary personnel or technical potential to tackle the issue.

New priorities do not focus on individual research fields but on defined social needs or specifically defined problems, which should be solved via RTDI activities. Other important factors taken into account were the application potential, human resources and research infrastructure. Within the STI Priorities for 2030 there are six priority areas related to the following: i) Competitive knowledge-based economy; ii) Sustainability of energy and material resources; iii) Environment for a good quality of life; iv) Social and cultural challenges; v) Healthy population; vi) Safe society. Each of these areas is structured into several sub-areas with defined targets.

In addition to a detailed list of the priority disciplines of R&D, this document also includes an overview of the necessary system measures to achieve successful progress in the field of R&D in general. Priorities are perceived as an important element of the Czech STI policy and targeted funding for social needs comes from public sources. For the first time, there is now a visible effort to take these needs into account when deciding about the distribution of public funds for RTDI, in particular through the applied research programmes carried out by the Technology Agency of the Czech Republic (TAČR).

## 3.2 Hungary

The most important Hungarian policy documents dealing with STI policy issues until 2007 included the *Science and Technology Policy – 2000*, the government programmes from the respective cabinets, the *National Lisbon Reform Programmes for Growth and Employment* (for various years), and the *Economic Competitiveness Operational Programme (ECOP)* of the first *Hungarian Development Plan (2004-2006)*. As the data presented in the Hungarian country study shows, practically none of the quantitative targets set since 2000 have been met.

The main aim of the *Government's mid-term STI policy strategy 2007-2013* – approved by the government in March 2007 – was to contribute to enhancing the competitiveness of the Hungarian economy and by 2013 to turn Hungary into a country "where knowledge and innovation are the driving engines of the economy. Companies with a domestic financial interest should offer competitive products on the global market." (p. 10) The strategy summarised the strengths and weaknesses of the Hungarian national innovation system, and set out several target indicators to be reached by 2010 and 2013, respectively.

The 2007-2013 STI policy strategy was supplemented by an Action Plan in August 2007. It listed almost 100 specific actions to be taken by various organisations or bodies, 25 of which required immediate governmental decisions. The deadlines and the responsible organisations were stated in

the document; the source of funding was also specified (where relevant) but the amount was not. A wide range of law amendments or other changes were initiated to achieve a more efficient system of innovation governance and financing, a more favourable economic environment, or for the co-ordination of policy tools. The vast majority of these actions were to be taken quite soon, with their deadlines ranging from December 2007 to December 2008. The second part of the Action Plan listed additional initiatives of the government that did not require immediate government decisions, but where future or continuous actions were seen as necessary. Due to a period of government crises, the continual reorganisation of the STI policy governance sub-system and economic pressure (and the consequent lack of commitment), only a few of the intended steps had been taken by the stipulated deadlines. The government therefore revised the STI policy action plan in February 2009, listing all the actions necessary to implement the medium-term STI policy strategy (2007-2013). The revised action plan consisted of much fewer actions, with slightly or significantly extended deadlines. This clearly indicated that the implementation of the plan was behind the original schedule.

The current STI policy, entitled the *National Research and Development and Innovation Strategy (2013-2020)* pinpoints the main features of the international environment; offers an overview of the Hungarian STI performance; highlights the strengths and weaknesses based on the 2011 Innovation Union Scoreboard indicators, discusses strategic options, presents a vision and sets quantitative STI policy goals.

Three main problem areas have been identified: the weakness of the knowledge bases and knowledge production; shortcomings in knowledge flow as well as knowledge and technology transfer; and obstacles to the (innovative) functioning of the business and community sectors involved in knowledge utilisation. Accordingly, the document recommends three priority axes:

1. Internationally competitive knowledge bases which can underpin economic and social progress,
2. Promoting co-operation in knowledge and technology transfer which is efficient both at national and international level, and
3. Innovative enterprises intensively utilising the results of modern science and technology, also in the public sector.

The overall vision is formulated as follows: “By 2020 the key participants in the national innovation system will be significantly reinforced by the active support of the RDI policy and will become equal partners in the global innovation processes in Hungary. They will then be able to invigorate the national innovation system as a whole, due to the follow-through effects, and thus contribute significantly to enhancing the competitiveness of the Hungarian economy, and also transform it into a sustainable knowledge economy.” (p. 28) It is also expressed in quantified objectives: “Hungary will increase its gross domestic expenditure in R&D to 1.8% by 2020, and to 3% by 2030.”[9]

Without doubt, the list of goals mentioned in the plan is impressive. The chances of implementing this strategy, however, may be strongly influenced by two recent developments: (i) it was developed by the Ministry for National Economy, and this Ministry has had no responsibility for STI policies since June 2014; (ii) the Secretary of State in charge of developing this strategy is no longer a member of the government.

## 3.3 Poland

The first complex innovation policy programme of the Polish government entitled *Increasing the innovativeness of the Polish economy up to 2006* was related to the EU financial framework for 2000-2006. It was launched by the Ministry of Economy in 2000, and in 2004 became part of the National Development Programme. It focused on four priorities: creating mechanisms and structures fostering

[9] Further details about this strategy can be found in the Hungarian country study.

innovative activities; forming innovative attitudes; improving the absorption capacity of the Polish economy and changing the consumption and production models towards sustainable development.

In 2006 the Polish government adopted (independently from the EU) the *National Development Strategy 2007-2015*. This document outlined the development goals for Poland while at the same time giving a realistic framework for the receipt and use of EU funds. On the basis of this strategy the second programme, *Guidelines for increasing economic innovativeness for 2007-2013,* was adopted. Following the Lisbon Agenda it aimed at transforming Poland into a "knowledge-based economy". It focused on 5 areas: human resources for the modern economy, research for the economy, intellectual property for innovation, capital for innovation and infrastructure for innovation.

The implementation of the STI policies initially played a marginal role on the political agenda, especially between 2004 and 2007 when 3 subsequent governments collapsed. It was only in 2007 that a period of relative political stability began. It allowed a package of legislation to be introduced, which established new organisations that were responsible for basic and applied science, modernising the funding system for science, as well as the status of the Polish Academy of Science. As a consequence of the new legislation, a major shift in policy implementation is being introduced to the current 2014-2020 agenda.

The current Polish innovation policy is directly derived from a document entitled *Europe 2020: A strategy for smart, sustainable and inclusive growth*. The goals of the EU policy – increasing GERD and BERD, increasing the number of people completing higher education, smart specialisation, strengthening links between business and science, internationalisation, improving education programmes – are reflected in the Polish strategies.

The *Strategy for Innovation and Efficiency of the Economy: "Dynamic Poland 2020"* is the most important government strategy document devoted exclusively to the innovativeness of the Polish economy. It is to be implemented by the Ministry of Economy as one of nine integrated strategies, it has a mid (10 years) and long-term (20 years) scope, with horizontal strategies for the development of Poland. *Dynamic Poland 2020* aims at transforming Poland into a highly competitive economy (innovative and efficient) based on knowledge and co-operation. The way to achieve this was set out in four detailed goals focusing on: the adaptation of the regulatory and financial framework; the stimulation of knowledge and labour through efficiency; increased efficiency in the use of natural resources and raw materials and the internationalisation of the Polish economy.

The *National development strategy for 2020* forms a common basis for nine integrated strategies and focuses on three areas: the efficient state, competitive economy as well as social and territorial cohesion (KPRM, 2012). The quantitative goals reflect the EU 2020 strategy goals while the main index of reference is the ranking in the Innovation Union Scoreboard. Three auxiliary indicators were adopted: BERD, GERD and the share of students at technical and natural sciences faculties compared to the total number of students. It is planned to achieve the following by 2020: 1.7 of the GERD/GDP ratio (from 0.74 in 2010); 0.6-0.8 of the BERD/GDP ratio (from 0.2 in 2010) and 30% (from 26% in 2010) for the last target indicator.

*The Long-term National Development Strategy 2030: Third Wave of Modernity* is the third policy document covering the overarching strategic concept of the development of the country. It defines the main global and regional trends and sets the main long-term goals. It also sets several goals for 2030: GERD at 3% of GDP, an increase in the innovation performance index compared to the EU average towards 75% (from 54% in 2010) and others.

At a more basic level the Polish government also operates on the basis of various programmes, two of which are the most important. The *National Research Programme* launched by the Ministry of Science and Higher Education aims at increasing the use of Polish science to raise the civilisation level of Poland. This is to be achieved by the plainer development of scientific results in education, the economy and culture. The second – the *Enterprise Development Programme 2020*, which also includes the *National Smart Specialisation Strategy,* has been devised by the Ministry of Economy.

This programme aims at high and equitable growth of productivity in the enterprise sector, thereby leading to higher competitiveness on a global level. Both programmes, although they have the lowest rank in the hierarchy of main strategic documents, will play a major role in the implementation of policies by the two respective ministries.

## 3.4 Slovakia

Since 2007 the government of the Slovak Republic has approved a number of strategic documents on science, research and development as well as technology and innovation. The following in particular are considered to be the most important:

1. The Long-Term Plan of the State Science and Technology Policy for 2015
2. The implementation strategy for the Long-Term Plan of the State Science and Technology Policy for the period 2015 to 2020
3. Update of the Long-Term Plan of the National Science and Technology Policy for 2015 (Phoenix Strategy)
4. Minerva 1.0 (2005 - 2010) and Minerva 2.0 (2011 - 2015)
5. Innovation Strategy of the Slovak Republic for the period 2007-2013
6. Innovation Policy of the Slovak Republic for the period 2008-2010
7. Innovation Policy for 2011 to 2013 within the framework of the Ministry of Economy of the Slovak Republic.

The first three strategic documents have been devised by the Ministry of Education, Science, Research and Sport of the Slovak Republic. They were focused on research and development. The Minerva 1.0 and 2.0 strategies were co-ordinated by the Ministry of Finance. The Innovation Strategy and Innovation Policies based on this strategy were co-ordinated by the Ministry of Economy of the Slovak Republic and these strategies were focused on innovations. So there were several strategies at the same time, adopted by different institutions. This fragmentation created problems with the coherence and continuity of documents.

*The Long-Term Plan of the State Science and Technology Policy for 2015* and *Innovation Strategy of the Slovak Republic for the period 2007 – 2013* identify the major barriers for economic development, such as the low involvement of science and technology in the overall development, problems with the infrastructure of research and development, low support for research, development and innovation from public sector or weak international scientific and technological co-operation. These documents also define the main objectives to tackle these problems.

The Minerva 1.0 and 2.0 strategies could be considered as being at intermediate stages of policy preparation in Slovakia. Minerva 2.0 was a strategy which aimed to move the country into the “First division”. It contains a number of measures to link academics with the business sector at University science parks. However, they have not yet been fully implemented.

The *Long-term plan of the science and technology policy of the Slovak Republic by 2015* aims to increase the involvement of science and technology in the overall development of the Slovak Republic – achieving a more intense involvement of science and technology in solving economic and social problems.

The Slovak government passed *the Long-term Plan for the Science and Technology Policy of the Slovak Republic by 2015* with government resolution no. 766/2007 dated 12th September 2007. It became the basic strategy for development of the Slovak R&D system up to 2015 and replaced the State Science and Technology Policy Concept for 2000-2005. On the one hand this new document takes into account the specific characteristics of domestic development, and on the other hand the objectives of the Lisbon Strategy regarding science and technology. It represents an improvement compared to the previous State science and technology policy concept, although there are still some

problems related to the applicability of the long-term plan. The main problem is that the scope of the defined priorities was too broad and had no thematic focus on selected priorities. 12 R&D priorities were determined in the long-term plan and the priorities were not based on any forecast. This led to a fragmentation of capacities and resources. All the goals/objectives were relatively general, without any appropriate indicators. An update of the long-term strategy (called the Phoenix strategy) follows this approach.

The "Innovation Strategy for 2007-2013" represents a step towards setting more specific objectives. The strategic objective has been defined as follows: "Innovation has become one of the main tools for developing the knowledge economy and contributes to the high economic growth of the Slovak Republic with the aim of reaching the level of the most developed economies in the European Union."

The strategy has identified priority areas for intervention such as high-quality infrastructure and an effective system for the development of innovation, high quality of human resources and effective tools for innovation. The strategy quantifies that Slovakia will achieve the following in 2013:

- A positive trend in the development of innovative processes in the economy and society,
- The successful implementation of projects,
- Innovations will contribute 25% to the growth in gross domestic product in the given year (presently the contribution is about 8%)
- Improved competitiveness, particularly of small and medium-sized enterprises,
- More than 50% of companies in industry and services, in particular SMEs, should be innovative, (according to the reports of the European Commission only 13% of SMEs have introduced new products, while 32% of the existing products were introduced as innovation in the period 2002-2004),
- More than 5% of corporate innovation will have links to universities, the Slovak Academy of Sciences (SAS) or private research (currently the proportion of innovation from universities and the academic environment is less than 1%).

Compared to the science and technology policy, the innovation strategy represents a new qualitative approach with better-defined and quantified output parameters at national level. These objectives are included in the measures of two innovation policies (the 2008-2010 Innovation Policy and the 2011-2013 Innovation Policy).

Evaluation reports about the Innovation Strategy and related policies are provided on annual basis (*Report on the implementation of the Innovation Strategy and Innovation Policy within the framework of the Ministry of Economy)*. According to the last report (for 2012 and the first quarter of 2013), Slovakia shows poor results in the intensity of innovation activities at enterprise level; expenditure on research, development and innovation projects which have been implemented in practice; in technology transfer; the use of venture capital; research in collaboration with industry, but also in many aspects underlying the efficient use of human resources. The quantitative goals listed above have not yet been evaluated.

The vision of the newly approved *Smart Specialisation Strategy* (RIS3) is defined as follows: "To drive structural change in the Slovak economy towards growth based on increasing innovation capability and R&D excellence to promote self-sustaining growth in income, employment and standard of living." This vision is to be accomplished with strategic objectives that are transformed into several partial objectives:

1. Deepening of the integration and embeddedness of key major industries to increase the local value added by the cooperation with local supply chains and turning local supply chains into embedded clusters.

2. Increased contribution of research to economic growth via global excellence and local relevance
3. Creating a dynamic, open and inclusive innovative society as one of the preconditions to increase the standard of living
4. Improving the quality of human resources for an innovative Slovakia

Table 3. Quantitative STI goals for 2020 in Visegrad Countries

| Czech Republic | Hungary | Poland | Slovakia |
|---|---|---|---|
| GERD/GDP ratio: 2.7% (from 1.40% in 2010) | GERD/GDP ratio: 1.8% (from 1.15% in 2010) | GERD/GDP ratio: 1.7% (from 0.74% in 2010) | GERD/GDP ratio: 1.2% (from 0.63% in 2010) |
| BERD/GDP ratio: to raise the ratio (from 0.81% in 2010) | BERD/GDP ratio: 1.3% (from 0.75% in 2010) | BERD/GDP ratio: 0.6-0.8% (from 0.2% in 2010) | BERD/GDP ratio: 0.8% (from 0.22% in 2010) |
| Share of tertiary graduates in the total number of youth 30-34 year old 32% (from 20% in 2010) | 56,000 researchers (from 35,700 in 2010) | Share of students at technical and natural sciences faculties compared to the total number of students 30% (from 26% in 2010) | Share of innovative enterprises (inhouse): 20% (from ~ 15% in 2010) |
| National state budget RDI expenditures to GDP: 2% (from 0.61 % in 2010) | | | Share of work force employed in knowledge oriented activities to 14%. (from 9,93% in 2010) |

The strategies adopted in the V4 countries do not always constitute a clear guidelines for policy-makers. Their fragmentation and delays in adoption make the innovation policy incoherent and inefficient. However, even if the structure of strategic planning is clear, as in the case of Poland, other problems as lack of leadership or secured financial resources in achieving particular goals may still arise.

# 4 Main policy instruments

The analysis of the STI policy instruments is usually based on the assumption of a linear model of innovation. It also distinguishes between push and pull instruments. The former focuses on supporting the supply side (creating ideas for innovations). It is usually accomplished by different grants for basic research and the first stages of applied research. The latter is related to the demand for innovations (for instance public procurement or standards).

The most common typology used in the analysis of innovation policy instruments is a three-fold distinction between 1) regulatory, 2) economic and financial and 3) soft instruments (Vendung, 1998; Salamon, 2002).

In order to allow a comparative analysis, this chapter combines the afore-mentioned typologies. It outlines 6 fields for STI policy instruments. An STI policy instrument (tool) is defined as a programme, scheme or mechanism used by a government to achieve one of its goals.

## 4.1 Public procurement

Public procurement is regulated in every Visegrad country by a dedicated act (or acts) and executive decrees. National legislation is adopted in accordance with the EC directives of 2004, (Directive 2004/17/EC and Directive 2004/18/EC) introduced with the primary goal of increasing transparency and openness to all European Union companies.

The attainment of these goals in the V4 has often been hindered by the relatively high exposure to corruption risks. As a recent study revealed (Transparency and accountability in public procurement, 2012) the cases of “accelerated procedures without proper justification, manipulation of thresholds or negligent use of notifications” were only some of the examples of illegal practices in Visegrad countries. The support of innovations in public procurement was never a priority in enhancing this system.

This is one of the reasons why existing procedures have often concentrated on the legal aspects and ignored the essential dimension of the procurement – selecting the best available solution (PARP, 2013). More importantly, in most cases public procurement remains neutral with regards to innovativeness, meaning that innovations do not enjoy any advantage over alternative, less advanced solutions. This leads to situations where in a basic form of public tender, the price is the primary (if not sole) factor.

All the V4 countries have made attempts to adopt pre-commercial procurement. Yet from a civil servant's viewpoint these new forms of tenders, although they potentially have a better chance of “picking” innovative solutions, are more “risky” and are therefore usually avoided (PARP 2013). That is why public procurement is not used as a smart tool to support the development of innovative solutions with possible social impact, for example in the form of social or eco-innovation (Jeck, 2012).

Another reason for this is that public servants in many cases are not experienced enough to choose the best innovative solution and justify that decision. An equally important gap is the lack of the mapping of the long-term needs of the public sector. An attempt to remedy this problem was proposed in 2011 in the Czech Republic where The Technology Agency launched a special BETA programme.

**BETA programme**

**This instrument covers public procurement in research, experimental development and innovation for the needs of public administration bodies. It aims at identifying the specific topics and issues that state authorities want to address through public procurement. Project selection in the programme takes place in two stages. Firstly, the Technology Agency collects the research needs formulated by governmental bodies and provides (in co-operation with the relevant ministries) an evaluation and final ranking. Secondly, the Technology Agency organises public tenders. Bids submitted by applicants are evaluated according to the evaluation criteria specified in the BETA programme. The results of selected projects have to be applied in practise. The length of projects in the BETA programme is between 6 and 36 months.**

Another problem with public procurement in V4 is the complexity of law. The most symptomatic example is Hungary where previously a single piece of regulation contained all the regulations concerning public procurement procedures, and now these rules are set out in around a dozen pieces of regulation. The system of public procurement in Poland is dominated by ex-post controls. The reduced use of ex-ante controls decreases preventive actions, which could lower the cost of mistakes. Such problems make the whole process long and often lead to delays or the postponement of the procurement process. To tackle the problem related to the length of public procurement, the Slovak government has launched a system of electronic services in public administration.

**E-Procurement system**

**The system controlled by the Public Procurement Office (PPO). A special portal (EPO electronic public procurement), administered by PPO, is available on-line. This portal significantly increases transparency and creates conditions to simplify and speed up the procurement process. It is an important anti-corruption tool. Access to the EPO portal is free. It makes it possible for small and medium-sized companies to also actively participate in tenders for public contracts. All the details about the contractor and customer are available on-line. One of the segments of EPO is an Electronic Auction System. This increases transparency by creating a ranking of offers by automatic evaluation based on pre-determined criteria.**

These problems also occurred to some extent in other EU countries and that is why it was necessary to replace them one decade after the adoption of the PP Directives (Directive 2014/24/EU and Directive 2014/25/EU). The priorities of the new legislation have two goals. Firstly, increasing the flexibility of procedures – both for the state and the bidders. Secondly, public procurement is to be more explicitly engaged as a tool for achieving particular policy goals such as innovation, environment protection or job creation. Additionally, special preference shall be given to small and medium-sized companies. The timeframe for the implementation of both directives is 2016 (except for the provisions related to e-procurement, which are to be implemented by 2018).

The recent amendments of the Public Procurement Law in Poland made in March 2014 were in line with the new EU legislation. A number of procedures have been relaxed. For instance, the threshold value for procurement above which a tender has to be created was substantially increased. Furthermore, the purchase of results of scientific research has been excluded from public procurement procedures. These and other measures allow public research institutes to become more flexible in performing their R&D activity.

## 4.2 Regulation on intellectual property rights

An even more complex area for innovation policy instruments concerns Intellectual Property (IP) rights. This is not only due to different types of IP such as patents, trademarks or industrial designs, but mainly because it is subject to different international agreements regulated by various national and international organisations. Equally complex is the European legislation about IP. It consists of over 30 regulations and directives.

A new system of patent protection is currently under development in the EU. The *European patent with unitary effect* has been created as an alternative to the existing *European patent*. It aims at reducing patenting costs as well as litigation costs. It is expected to enhance the competitiveness of inventions generated in the European Union compared to countries like the USA or Japan. The system is supported by most of the EU countries including Czech Republic, Hungary and Slovakia. Poland[10] together with Croatia, Italy and Spain, have all voiced doubts about the fairness of the system.[11]

Currently, the protection of Visegrad inventors is most commonly ensured at national level. Dedicated offices[12] provide specific tools oriented to supporting entrepreneurs and scientists in the protection of their rights. Soft instruments like training courses, publications and campaigns are often supplemented by structural funds, although the V4 countries have also developed their own instruments.

One such instrument is PATENT PLUS – a Polish programme financed by the Ministry of Science and Higher Education.

**PATENT PLUS**

**This has been designed to increase the level and quality of intellectual property protection by providing financial aid to inventors selected in a competition. This support is primarily oriented to protecting IP abroad (which in the case of Poland is a critical problem compared to the other V4 nations). The programme can cover the costs of economic analysis or the commercialisation of the invention. It may also provide financial support for registering patents in other countries or using the EPC (European Patent Convention) or PCT (Patent Cooperation Treaty) procedure.**

Another instrument which is provided by the Slovak Industrial Property Office (IPO SR) offers ex-ante diagnostics for enterprises, including an analysis of the current situation in intellectual property or the provision of information about the best possible way of protecting intellectual property. The office also grants the *Ján Bahýľ Award* every other year for exceptionally valuable technical solutions.

In addition to its standard activities, the Industrial Property Office of the Czech Republic organises educational, promotional and publishing activities particularly through the Industrial Property Training Institute.

[10] Poland argues that the acceptance of three languages – French, German and English – significantly favours the entrepreneurs and inventors from those countries where these languages are spoken. The translation of the patent is an additional financial burden for companies coming from different countries. Also the translation of the judicial proceedings would become a burden for companies whose working language is different from these three languages. From an economic perspective an important issue is safeguarding the competition between young companies from the "new" member states and large companies experienced in patenting in EU15.

[11] The ratification process is composed of three elements: 1) entering into enhanced cooperation for the unitary patent protection; 2) The signing of the Agreement on a Unified Patent Court; 3) The ratification of the Agreement on a Unified Patent Court.

[12] Industrial Property Office (CZ), National Intellectual Property Office (HU), Patent Office of the Republic of Poland, Industrial Property Office of the Slovak Republic.

In the Czech Republic and Slovakia supporting organisations also exist. The Centre of Scientific and Technical Information (CVTI), located in Bratislava, provides an instrument co-financed from EU Structural Funds, called the "National Infrastructure for Technology Transfer support in Slovakia, NITT SK". It aims at creating a system to support the application of research and development results into social and economic practice. For example, it provides funds to identify intellectual property with potential for commercialisation, to search for potential partners for commercialisation and to implement commercialisation, leadership and administration.

In the Czech Republic, the Technology Centre (TCAV), one of the institutes of the Academy of Sciences, offers introductory advice free of charge about the protection and enforcement of intellectual property rights. It also organises training seminars, conferences and provides specialised publications designed especially for small and medium-sized enterprises and workers in applied research and development, which are all free of charge. It co-operates mainly with the Industrial Property Office and selected law firms.

Financial support for IPR protection and the commercialisation of research results is obviously part of the programmes aiming at applied research and experimental development. Programmes managed by the state Technology Agency (TACR) and financed from the state budget can cover these costs in relation to the project results.

To strengthen IPR protection especially among SMEs, individuals, research organisations and universities, the Ministry of Industry and Trade launched the "Innovation" scheme, which is managed by the state agency Czechinvest and co-financed from structural funds. Part of the programme helps cover IPR protection costs abroad and in some cases also in the Czech Republic (patent representatives, administrative charges and translation).

Hungarian government offers a support of IPR protection for Hungarian inventions abroad**.** Furthermore, the Hungarian Intellectual Property Office runs a programme, called VIVACE, to raise awareness about the intellectual property system amongst small and medium-sized enterprises (SMEs) and to nurture their industrial property culture.

## 4.3 Tax incentives

It is claimed that tax incentives stimulate higher business expenditure for R&D. Firstly, as a market-based instrument they are perceived as impartial and neutral to the market. They can be also used to avoid direct state-aid, yet still directly support home-based companies. Finally they are an important factor for international companies when choosing the location of their R&D centres. With appropriate measures, states can use this potential to create knowledge spill-overs. That is probably why the number of OECD countries that have introduced tax incentives has doubled since the mid-1990s. (OECD, 2013)

Tax incentives in Hungary allow companies to use a "super-deduction", i.e. to deduct 200% of their R&D expenditure from their taxable income. Since 2001 this option has also been available for R&D activities commissioned by public or non-profit research organisations. A company can claim a 300% tax allowance if its R&D unit is located at the site of a university or public research institute.

Super-deduction has been granted to companies in the Czech Republic since 2005. In practice, 200% of R&D expenditures can be deducted from the tax base of a particular legal entity. Consequently, a company pays 19% less than what it would pay without this measure. Until 2013, it has been possible to claim tax deductions solely for expenses on a company's own research, while since 2014 this tax

benefit also applies to costs associated with the purchase of R&D services from public research organisations and higher education institutions.

**Super deduction**

'Super deduction' schemes allow companies to deduct R&D expenditures from their taxable income which is greater than the actual expenditures incurred for R&D. They vary in the deduction rate and the expenditure eligible for deduction (EY 2010). The deduction rate varies from slightly above 100% to 400%. The expenditure eligible for deduction can include design expenditure for new products, expenditure on direct materials, personnel expenditure, depreciation, lease expenditure etc.

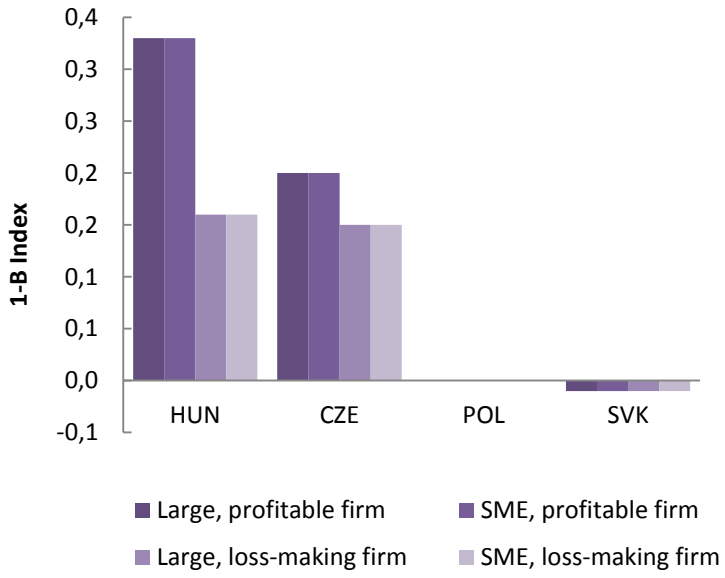
In Poland there are currently two tax instruments aimed at supporting innovation. A company can deduct up to 50% of its expenditure on new technology from its tax base (contrary to the Czech Republic where the costs of in-house R&D are not included). The second instrument is a system of tax exemptions and deductions for R&D centres that allows expenditure on an innovation fund to be deducted from the tax base if it amounts to up to 20% of total revenue, as well as providing exemption from property and land taxes. However, as of June 2014, there were only 31 R&D centres eligible for preferential tax treatment. Both instruments are assessed as ineffective and insufficient even in governmental documents (Enterprise Development Programme 2020; 2013).

Currently, there are no tax instruments to support research and development in Slovakia, except for the option of using the instruments defined by the Investment Aid Act and the Act on Incentives for Research and Development. Under the Investment Aid Act, companies can for example apply for investment aid to create a technological centre. Support can be provided by a cash grant – for the acquisition of tangible and intangible fixed assets or to contribute to the creation of new jobs. In addition, they can also receive tax relief, depending on the eligible amount. The amount of aid depends on the region where the project is realised, underdeveloped regions with high unemployment rates have preferential status. The taxpayer is allowed to claim tax relief up to the amount of the tax incurred on the proportional part of the tax assessment base. According to the Act on Incentives for Research and Development, the support is aimed at improving the quality of research and development activities (fundamental research, applied research, feasibility studies, industrial ownership protection etc.). One type of investment aid is income tax relief on the expenditure incurred for research and development within a project for which incentives have been approved.

The Ministry of Finance already prepared a proposal and plans to introduce real tax incentives for R&D in 2015. These tax incentives should be focused on firms conducting their own research and development. Companies should be able to decrease their tax base for expenditure on their own research and development.

The tax subsidy rate is calculated by OECD as 1 minus the B-index. The B-index measures the pre-tax income needed to break $1 of R&D expenditure. It is calculated for representative small and large corporations. The tax subsidy rate is reported for a profitable company able to claim tax credits/allowances. The subsidy rate calculations only include expenditure-based tax incentives and do not account for income-based tax incentives.

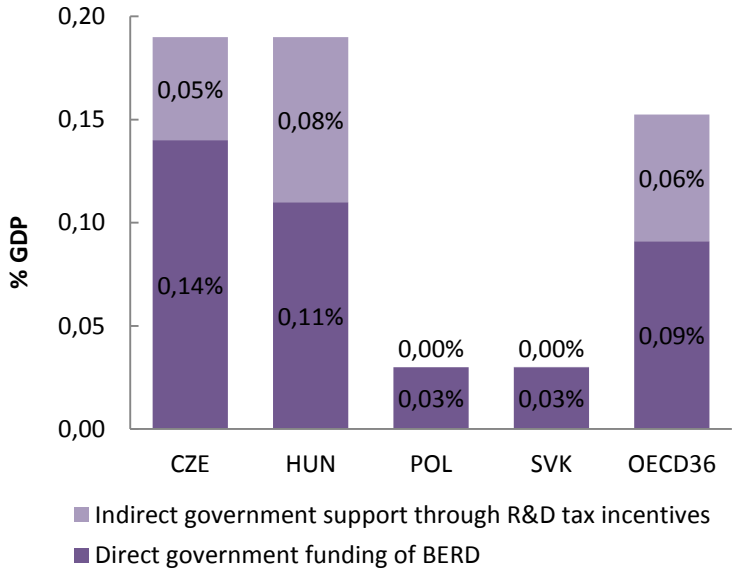
**Figure 1. Tax subsidy rates on R&D expenditure, 2013**




Source: OECD

OECD countries differ in the division of types of government support for R&D. All V4 countries rely more on direct support like grants or other subsidies. The share of indirect government support (e.g. tax incentives) is highest in Hungary and then in the Czech Republic.

**Figure 2. Direct government funding of business R&D and tax incentives for R&D, 2011**



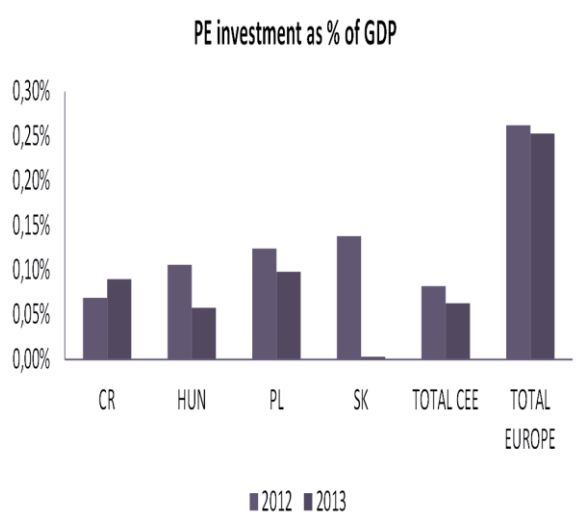

Source: OECD

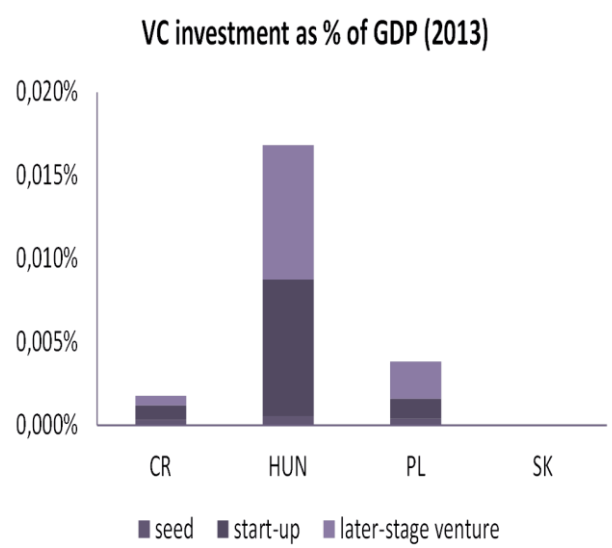
## 4.4 Private Equity & Venture Capital

Private equity (PE) and Venture capital (VC) are the two main financial instruments which deal with high-risk investments. The distinction between these instruments is a matter of discussion but most commonly the former is seen as a group of instruments or sometimes as an instrument supporting mature projects, whereas the latter is one of the PE tools designed to support investment at an early

stage. However, in developing PE & VC markets, such as Poland, the difference between the two is often unclear.

**Figure 3. Private Equity and Venture Capital investments as % of GDP**




*Source: EVCA/PEREP Analytics for investment data and Thomson Reuters for GDP data*

The availability and use of VC depends on the stage of development of the company (fig.3). Poland and the Czech Republic reflect a common pattern in CEE countries. Companies in the buy-out and growth stage use the majority of PE investments. Investments in early-stage companies (VC) in 2013 in Poland amounted to 4%, and in the Czech Republic to 2% of PE (fig. 2). In Slovakia all the PE was used by companies in the growth stage. Hungary represents a different pattern where most of the PE investments were channelled into companies in the growth stage (64%) and in early-stage (31%). (EVCA Report, 2013).

The availability of PE/VC in the V4 is low compared with the EU15 (fig. 3). In 2013 only the Czech Republic and Poland had more PE investment as a % of GDP than the average from the other CEE countries. The first hit of the economic crisis substantially reduced that level even more in the whole of the EU including the Visegrad countries. As a consequence, the value of new investments in high-risk projects decreased and the available capital moved to smaller and less risky projects. Some positive trends in the restoration of PE/VC availability were observed in following years, yet so far they have not reached the level of before the crisis.

The availability of the PE/VC in V4 countries also varies across different sectors. They are concentrated on industrial products and consumer goods in the Czech Republic, transportation in Hungary, telecommunications and consumer goods in Poland and the health sector in Slovakia (EVCA Yearbook, 2012).

The majority of PE/VC in CEE comes from outside the region. The low share of available early-stage venture capital was being addressed in the V4 by several EU instruments, mainly by the Jeremie Initiative and the Entrepreneurship and Innovation Programme (*EIP*). Switzerland also transferred its support to the EU11 in the form of VC as part of the Swiss Contribution Programme. Other important sources are further public sources, including funds from the EIB and EBRD.

Most of the capital for high-risk projects in Poland comes from the National Capital Fund - a fund of funds (of which 100% of the shares are owned by the *Bank Gospodarstwa Krajowego* – Poland's

state-owned bank). Its resources come from the state budget, EU funds and from the Swiss support. In Hungary the Corvinus Venture Capital Fund plays an important role, which was established by the state-owned Hungarian Development Bank. The Start Equity Guarantee Fund has offered equity guarantee for professional financial investors investing in Hungarian SMEs.

Private investors are the main source of PE/VC in the Czech Republic. This could explain the very low level of VC available to companies in an early-stage of development. In Slovakia, PE/VC is rather scarce compared to other V4 countries, the main reasons for this are the lack of knowledge and interest in using this financial instrument as well as the lack of potential investors.

## 4.5 Favourable loans

The New Hungary Enterprise Promotion Loan Programme scheme has provided preferential loans to micro, small and medium-sized enterprises with the aim of enhancing their role in employment, strengthening their innovation and supplier activities and to contribute to their environmental and health-related investments. Development loans are specifically provided for the development and upgrading of the RTDI infrastructure, enhancing innovation capabilities and financing innovation centres.

Entrepreneurs in Poland can use two different credits for innovative projects: technological credit and preferential credit. Both instruments are intended for small and medium-sized firms to finance innovative projects. Technological credits can only be used to finance technological innovations. By contrast, preferential credits are awarded with the European Investment Fund warranty and can be used to finance all types of innovations. Entrepreneurs can obtain loans from 25,000 to 7 mil. €, for a period of 2 to 7 years.

The Micro-loan Programme has been running in Slovakia since 1997. It addresses the issue of the access of small companies to this capital. It focuses on increasing the rate of survival of micro and small enterprises and start-ups, thereby creating conditions for job maintenance and job creation in different regions of Slovakia. Since the launch of the micro-loan programme, almost 2,000 micro-loans have been provided, amounting to over € 30,000 (as of 2012).

In the Czech Republic, the Czech-Moravian Guarantee and Development Bank was founded in 1992 and its long-term goals and primary business are focused on **providing assistance to small and medium-sized enterprises,** with the aim of providing them with easier access to financial capital, sharing their business risk and reducing their project costs through different types of support tools such as bank guarantees, preferential loans and financial subsidies. The bank also provides programmes co-financed from structural funds such as START, PROGRES and ZÁRUKA.

## 4.6 Mobility schemes for scientists (human resources policy, brain circulation)

The mobility of academics is one of the key targets of the Bologna Process, and was reaffirmed recently in the *Mobility strategy 2020 for the European Higher Education Area (EHEA).* The process has already lasted 25 years and has led to substantial achievements. However, looking at the V4 countries it is clear that mobility is still a major challenge.

An important opportunity for mobility in the V4 is provided by the Structural Funds implemented by the respective operational programmes. Equally important are the specific EU programmes such as *Marie Curie, Erasmus Mundus* or *Leonardo da Vinci*, which are currently part of the *Erasmus+* programme. Additionally, Euraxess provides information about job opportunities, advice and assistance on visa procedures, social security, taxes and other practical aspects of everyday life in each EU country.

The EU instruments are supplemented by national programmes. In addition to creating possibilities for internships at research institutes abroad, these programmes also aim at attracting researchers working abroad to come back to their home country as well as attracting foreign researchers to come to the V4. Various national programmes support the functioning of brain circulation.

Czech universities mostly have international offices that provide information on mobility opportunities not only to students but also to staff.

During the last decade, the following measures have been implemented in order to simplify the conditions for the inward flow of researchers and thus enhance the "brain gain":

- The EU directive on the Scientific Visa Package was implemented in Czech legislation in December 2007. Since this date, a scientific visa has been available and can be applied for.
- A programme to attract qualified experts from third countries - the *Selection of Qualified Foreign Workers* - has been managed by the Ministry of Labour and Social Affairs since 2003. The advantages of this programme were the shortening of the time needed for highly-qualified workers and their families to receive permanent residency. However, the number of participants was not as high as the ministry initially expected. Furthermore, as a result of the budget cuts caused by the recession, the programme was closed in 2010.
- Czech research organisations have been linked to various systems for the international advertising of research vacancies, including the European Researchers' Mobility Portal.

The researchers´ mobility is also supported by financial tools and programmes which are also the responsibility of the Ministry of Education for Youth and Sport. The *Mobility* support programme is organised and co-financed by the Ministry. Its goal is to send researchers on short-term internships to partner institutions based on bilateral state agreements. Grants are awarded to public higher education institutions, research organisations and also to individuals.

As the low salaries in the Czech academic and research sector constitute one of barriers when trying to attract foreign researchers, a special support for researchers/specialists returning to the Czech Republic after a stay abroad has been designed and co-financed from structural funds. It supports the reintegration of researchers into Czech research institutes, the continuity of their careers and the building of research teams under their leadership. As institutions based in the Prague region were not eligible to use these sources, a similar programme called *Návrat* (i.e. Return) was organised and financed by the Ministry of Education and Sport.

Important measures supporting the international mobility of researchers are also used by the new large R&D infrastructure that is currently being set-up using resources from the EU Structural Funds (OP Research and Development for Innovation). Structural funds are also used to support research organisations and universities in creating postdoctoral (post-doc) positions for young researchers from abroad and for the international mobility of Czech postdocs.

In addition, there are some regional initiatives (e.g. in South Moravia) which provide grants to attract scientists from abroad to regional universities or research organisations, or to foster the re-integration of Czech researchers after they have returned from abroad.

A number of similar instruments are also present in Hungary. The *Bolyai Janos Research Scholarship* **is** aimed at creating more favourable conditions for R&D and providing motivation for and acknowledgement of outstanding research activities in the country. It provides financial support for young researchers (under the age of 45) for the duration of one, two or three years, supporting the preparation of their studies or other scientific research work of equivalent quality, and research performed in order to obtain advanced scientific degrees and qualifications.

The *Development of human resources for basic research* scheme has supported the development of the Hungarian human resource base for basic research by:

- Funding Hungarian researchers with scientific degrees currently working abroad in order to establish cutting-edge research units in Hungary;

- Funding the research projects of young postdocs at internationally recognised Hungarian or foreign research organisations;
- Funding the access of Hungarian postdocs and PhD-students to international research infrastructure and equipment.

The *Momentum* (Lendület) Programme of the Hungarian Academy of Sciences (HAS) provides funding for young Hungarian researchers to set up their own research teams at HAS institutes or universities. Originally it targeted Hungarian researchers working abroad (to attract them back to Hungary), but more recently has taken a broader scope.

The Hungarian *Eötvös Scholarship Programme* provides financial assistance to outstanding young Hungarian researchers for participation in training and education programmes at foreign universities, research institutes and workshops. Applications are invited from every field of science in two sub-categories: pre-doctoral applications (PhD students) and post-doctoral applications (PhD or DLA graduates).

In Hungary, the employment of researchers with a PhD (with salaries of ~€1,800 per month) has become cheaper since January 2013: companies are now exempt from paying social security contributions and other contributions (in total 27% less).

Foreign researchers and PhD students can also apply for Hungarian grants to conduct research in Hungary.

In summary, over recent years various mobility schemes – not all of which are mentioned here specifically – have supported the following**:**

- Outgoing mobility: grants for researchers with Hungarian citizenship to promote their international activities at excellent international research organisations.
- Incoming mobility: support for non-Hungarian researchers with their employment at Hungarian research institutes to promote international scientific co-operation and knowledge transfer.
- Reintegration (or reversing brain drain): grants for Hungarian researchers who have been working abroad to establish their own, new research unit in Hungary.

Hungary was one of the first countries to implement the 2005/71/EC Directive concerning the employment of researchers from third countries. Simplified visa procedures for third-country researchers have been implemented in accordance with the European Directive by Government Decree 114/2007 (in effect since December 2007).

To date, Polish mobility programmes have concentrated on young researchers. The programmes are mainly offered by four organisations – the Ministry of Science and Higher Education, Polish Academy of Science, National Science Centre and the Foundation for Polish Science.

A major part of the programmes focusses on grants for research abroad for PhD students such as *Mobility Plus*, post-doctoral research (*Kolumb*), sabbatical leave for professors (*Mistrz*) or participation in large international projects where the participants are offered no financial support (*Harmonia*).

A fraction of the programmes available offered Polish researchers a possibility to return from abroad and continue their research career in Poland (*Homing+*) or involve them and other foreign researchers in new projects coordinated in Poland (*Welcome*).

Some of the programmes are designed to - amongst other goals - support the mobility of researchers by offering open access to participation in research teams – *OPUS, SONATA, MAESTRO, SYMFONIA, TEAM* and others. Yet the remuneration offered within these programmes is not sufficient to effectively attract researchers from Western countries.

An important part of the problem with the mobility of Polish scientists is also caused by regulatory barriers both at state and University level. The administrative burdens to foreign researchers or the lack of bilingual requirements for administrative staff are still common problems. Universities also prefer employing their own students at the cost of external ones for available posts.

The brain drain from Slovakia is a problem that has not been solved in the long term. Major activities to solve the problem have focused on the return of researchers from foreign institutions back to Slovakia. One of the examples of successful activities is the *M. R. Štefánik* scholarship. Its aim is to provide scholarships to selected students at prestigious foreign universities, wherein one of the conditions for granting scholarships is the return of these students to Slovakia and their subsequent operation within central state administration institutions (especially at the ministries).

In 2005 the Slovak government approved the creation of the National Scholarship Programme to support the mobility of students, PhD students, university teachers and researchers. The National Scholarship Programme is funded by the Ministry of Education, Science, Research and Sport of the Slovak Republic. It provides scholarships to cover living costs during the study course or research stay.

# 5 Frameworks, processes and instruments for policy-preparation

## 5.1 Organisational framework for innovation policies

### 5.1.1 Czech Republic

In the Czech Republic the Ministry of Education, Youth and Sports (MEYS) has been responsible for R&D policy governance. Other ministries have managed their own R&D, where it had more of an applied research character. This situation became more complicated when innovation issues gained prominence. The Ministry of Industry and Trade in particular became an important player and co-ordination issues were of critical importance.

Currently, three main governmental bodies play a leading role in research and innovation governance. The Research, Development and Innovations Council, established by the government in 2009, is an expert and advisory government body. At the political level, the Council plays the main strategic and coordinating role in the research and innovation governance system. The Ministry of Education, Youth and Sports (MEYS) is a central administrative authority responsible for research and development, although "with the exception of areas that are covered by the RDI Council". Consequently the STI policy strategies are set by the RDI Council. The Ministry of Industry and Trade (MIT) is responsible for industrial research and development and promoting innovation in the business sector. The ministry prepares and implements programmes for industrial research and innovation support in the business sector, especially through its public agency Czechinvest which also plays a larger role in supporting entrepreneurship and investments in the Czech Republic.

In addition to MEYS and MIT, there are five other ministries responsible for the preparation and implementation of research, development and innovation concepts: the respective ministries responsible for health, agriculture, culture, defence and the interior. These ministries provide support from their own budgets and also establish and operate their sector research institutes. Furthermore, the Technology Agency of the Czech Republic (TA CR) was established in 2009, and complements the Czech Science Foundation (CSF) which supports basic research. The TA CR focuses on the implementation of applied research programmes. Apart from the governmental institutions, other organisations and associations (e.g. Association of Innovation Entrepreneurship, Chamber of Commerce) are also involved in the RDI system of the Czech Republic.

Despite the creation of the RDI Council as a co-ordination body, a recent international audit (Technopolis Group, 2011) described the Czech STI policy governance system as highly fragmented and lacking co-ordinated activities or synergies among its key actors. As a matter of fact, within the Czech Republic there is only a limited ability to implement strategic directions and objectives. Many strategic documents have been developed in areas related to R&D, human resources and tertiary education, but only a fragment of these documents have been successfully implemented in practice (e.g. HRD strategy, Tertiary education reform). Most competences are strictly exclusive to specific ministries and mutual co-operation often proves to be difficult. Many conceptual issues are being politicised, which makes it even more difficult to achieve a broader consensus, especially concerning

the financial issues and governance. It was also stressed that the RDI Council is only partially fulfilling its role. Its task was to prepare and evaluate the implementation of the national STI policy, develop R&D priorities, plan the budgets for R&D funding and devise an evaluation methodology. Due to budgetary pressures, the RDI Council started to focus excessively on budget issues at the expense of co-ordinating long-term strategies. The Council's powers in relation to other bodies of public administration – in particular to the MOEYS and MIT – were not clearly defined. At present, the RDI Council is being reorganised and its future role is being discussed. According to the international audit recommendations, the RDI Council should involve representatives from the relevant ministries. The RDI Council should make statistical, analytical and evaluation studies publicly available in order to allow the transparent creation of STI policy based on open dialogue.

The current division of responsibilities among the RDI Council, MOEYS and MIT places demands on co-ordination of activities at both national and international level (participation in EU programmes and initiatives). However, this cannot be changed without a fundamental shift in the Czech state administration system. It is therefore necessary to precisely define the responsibilities of the principal state authorities, the RDI Council as well as the funding organisations to ensure the effective implementation of STI policies.

### 5.1.2 Hungary

The science, technology and innovation (STI) policy governance structure has been in an almost permanent state of flux since the early 1990s, including the highest level policy-making bodies, as well as the implementing agencies. These frequent changes in governance structures (i) prevent organisational learning by policy design and implementation bodies, and the lack of stability also hampers their efficient functioning; while also (ii) putting a significant administrative burden on research performers. (ÁSz 2008a, 2008b; Ernst & Young and GKI, 2010b; Havas and Nyiri 2007; Havas 2009; OECD 2008)

Just to illustrate, several fundamental changes have occurred since May 2008, when a major government reshuffle took place, which have affected the STI policy-making structures. A new position was created: a minister without portfolio was appointed who is responsible for "overseeing and co-ordinating R&D, technological innovation and science policies". Furthermore, the STI policy action plan for 2007-2010 (approved by the government on 29 August 2007) stipulated that the STI governance system should be overhauled. Some elements of this plan were introduced by a government decree, approved in March 2009. The Prime Minister, however, resigned in April, and these organisational changes had not been implemented, except for one: the highest-level co-ordination body in the field of STI policy – headed by the Prime Minister – called the Science and Technology Policy Council (TTPK), was abolished. The second fundamental change occurred in April 2009, when a new government was formed (supported by the same political party as the previous government), and the position of the minister without portfolio, responsible for co-ordinating R&D, technological innovation and science policies was dissolved. Half a year later a new high-level STI policy co-ordination body was created by a government decree (in September 2009), called the Research and Science Policy Council (to replace the dissolved Science and Technology Policy Council), which had somewhat revised responsibilities. It held its first and only meeting in February 2010, chaired by the Prime Minister. Following the general elections held in April 2010, a new government took office in May 2010, which lead to more organisational changes in STI policy-making. Although the same political parties won the elections in April 2014, the STI policy-making bodies were once again changed.

The current situation (as of July 2014) can be summarised as follows. The Committee on Culture, a standing committee of the Hungarian Parliament is the highest-level political body in the field of science policy. There is no standing committee dedicated to technology and innovation policy.

The Research and Science Policy Council was disbanded on 15 December 2010 – that is, just 10 months after its first meeting – by a government decree stipulating the creation of the National Research, Innovation and Science Policy Council (NKITT). The NKITT was chaired by one of the Deputy Prime Ministers, co-chaired by the President of the Hungarian Academy of Sciences, and was composed of three ministers responsible for the economy, national resources and national development. The NKITT was dissolved on 2 July 2012 by the same decree that created the National Development Cabinet (NFK). The NFK is chaired by the Prime Minister and comprises three ministers: the minister responsible for the Prime Minister's Office and two others, 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 over HUF 1 bn, i.e. around € 3.3 m), including projects and schemes that support RTDI activities, have to be discussed and approved by the NFK.

A new high-level co-ordinating body, called the National Council for Science Policy and Innovation (NTIT) was formally established by a government decree issued on 25 September 2013. The NTIT is supposed to be chaired by the Prime Minister, co-chaired by the President of the Hungarian Academy of Sciences and composed of the same four politicians who used to be members and the co-chair of the NKITT. Its mandate is also very similar to that of the NKITT (and the other high level STI policy bodies under various names which were established and then abolished in the previous years). In practice, however, as of July 2014 the NTIT has not even held its inaugural meeting.

The ministries responsible for various domains and tasks relating to STI policies were also reorganised and renamed in 2010. In 2010-2014 these were the Ministry for National Economy (its minister also supervised the National Innovation Office [NIH]), the Ministry of National Development (its minister oversaw the Research and Technological Innovation Fund [KTIA], the main national source for funding R&D and innovation policy schemes, as well as the National Development Agency, which manages the measures co-financed by EU Structural Funds) and the Ministry of National Resources (which supervises all levels of education, including higher education, and co-ordinates science policy, and was renamed as the Ministry of Human Resources on 14 May 2012).

Since June 2014, however, the STI policy responsibilities of these ministries have changed significantly once again. The main actor now is the minister responsible for the Prime Minister's Office, whereby the Department for R&D and Innovation has practically taken over the former competencies of the Ministry for National Economy in this policy domain. This ministry now mainly has an implementation role for STI policy schemes co-financed by the EU Structural Funds, and also took on the tasks from the former Managing Authority (National Development Agency) and Intermediary Organisation (MAG Zrt) in April 2014. The Research and Technological Innovation Fund (KTIA) is now overseen by a new government commissioner responsible for "establishing the National Research, Development and Innovation Office", who is also supervising the Department of R&D and Innovation at the Prime Minister's Office and the National Innovation Office. As a result, the minister responsible for national development has lost a major STI policy role, and now the only STI policy competence he/she has retained is the ability to oversee space research. The Ministry of Human Resources, however, has kept its previous responsibilities concerning education, and is also charged with co-ordinating science policy together with the President of the Hungarian Academy of Sciences.

At the operational level, the National Innovation Office (NIH) is responsible for implementing several elements of the government's technology and innovation policy. This office (originally called National Office for Research and Technology, [NKTH]) was reorganised (and renamed) in January 2011, for the third time since 2007.[13] Funds allocated through the Operational Programmes of the New Hungary

[13] The NKTH was established in 2004, and its President was supposed to have a fixed, 6-year term, set on purpose to exceed the 4-year mandate of the government. However, the first President left his office after 3 years, and then two other people shared this fate before 2010. Between 12 August 2010 and 29 January 2011 an acting President managed the NKTH, followed by a new general Vice-President until 17 March 2011, when a new President was appointed. The general Vice-

Development Plan (2007-13) used to be managed by the National Development Agency (NFU) until 1 January 2014, when the functions of the various Management Authorities were delegated to the respective ministries. STI policy support schemes – both the ones financed by the Research and Technological Innovation Fund and the ones co-financed by EU Structural Funds – were administered by an implementing organisation, called the Hungarian Economy Development Centre (MAG Zrt.) until April 2014, when these tasks were taken over partly by the Ministry for National Economy, and partly by the regional development agencies.

The Research and Technological Innovation Council (KuTIT), which used to provide strategic guidance to the National Office for Research and Technology (NKTH), was dissolved as per 31 December 2010. It used to comprise 15 members, with 6 delegated by the relevant ministries (mostly state secretaries), 6 by various business associations and 3 other representatives of the RTDI community. Consequently, an important level of policy co-ordination is missing, namely that performed by senior civil servants (secretaries of states or their deputies), and the involvement of stakeholders has become far less regular and formalised.

### 5.1.3 Poland

STI policy in Poland is mainly devised by two ministries: the Ministry of Economy and the Ministry of Science and Higher Education. Although formally the Chancellery of the Prime Minister was responsible for the co-ordination of this policy,[14] it has not managed to make its actions fully coherent and to eliminate tensions between the ministries.

Since 2007 the Ministry of Economy has been governed by the smaller coalition partner. The ministry also supervises the Polish Agency for Enterprise Development (PARP). Created in 2000, the Agency was the main government body responsible for promoting entrepreneurship and allocating the EU Structural Funds in Poland (until 2013).

The Ministry of Science and Higher Education, in turn, is headed by the bigger coalition partner. It created two agencies responsible for supporting STI policy in Poland. The National Centre for Research and Development (NCBiR), which is responsible for applied science, and the National Science Centre (NCN), which is responsible for basic science. The former, apart from the dedicated programmes supporting innovation, also took over the primary responsibility for managing the Polish schemes, co-financed by the EU Structural Funds, related to innovation in the 2014-2020 planning period.

The Foundation for Polish Science also plays an important role. The Foundation is a non-governmental, non-political and non-profit organisation, although it is created and supported from the state budget. Its main goal is to support Polish science through different grants, prizes and scholarships. It is also responsible for distributing the structural funds relating to the RTDI system.

The role of the Ministry of Finance is also important, although it is rather difficult to say it is pro-innovation. As of yet, the arguments of the Ministry of Finance concerning the introduction of tax exemptions for innovators is that the excessive budget procedure applied by the European Commission to Poland for the last 5 years did not allow the risk of shrinking budget revenues to be taken.

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President appointed on 29 January 2011 was sacked after four months. A new Vice-President was appointed in June 2011 and then fired three months later. A new President was only appointed in 2014. In total, in eleven years there were 5 Presidents and several acting presidents at the helm of NKTH and its successor, the NIH. Moreover, the NIH is to be reorganised and renamed again before 31 December 2014, as the name and mandate of the new government commissioner responsible for "establishing the National Research, Development and Innovation Office" clearly suggests.

[14] It transferred this competence as well as tasks related to monitoring to the Ministry of Infrastructure and Development in 2012

Interestingly, the role of another ministry, the Ministry of Treasury, regarding innovation may grow more in the coming years as its newly adopted priorities suggest. The Ministry still controls (entirely or partly) a large number of companies in Poland. In its redefined mission the privatisation process is no longer its top priority but rather the enhanced supervision and increase of companies' value as well as their innovativeness. To a certain extent the ministry follows the path of the subordinate Industrial Development Agency. The Agency, which supports large Polish companies, evolved from initially undertaking activities concentrating on the restructuring and modernisation processes, to support their development.

However, as some experts suggest, so far the close involvement of Polish government in the business sector has led to several inefficient decisions (Gadomski, 17.3.2014). The investments in innovation, which are closely controlled by state bodies, will n be as efficient as those taken without engaging politicians.

### 5.1.4 Slovakia

In Slovakia the policy-making process is typically a top-down approach with the ministries exerting a large amount of power. The key policy-making actors are the Ministry of Economy and the Ministry of Education, Science, Research and Sport of the Slovak Republic (SR) which have a relatively comprehensive network of agencies. The Ministry of Economy is in charge of innovation policy, while the Ministry of Education, Science, Research and Sport is responsible for research and development.

Under the Ministry of Economy is the Slovak Innovation and Energy Agency (SIEA), State Agency for the Development of Investment and Trade (SARIO), Slovak Business Agency (SBA) and Innovation Fund. Government agencies under the Ministry of Education include the Scientific Grant Agency (VEGA), Research and Development Agency and the Structural Funds Agency. The Government Council for Science, Technology and Innovation is a permanent expert, advisory and co-ordination body of the Government for science, technology and innovation.

In addition, other ministries also promote research and development activities. For example, the Ministry of Interior and the Ministry of Defence have several institutes that conduct research activities. The Ministry of Environment is the founder of several research institutes: the Slovak Hydrometeorological Institute, the Water Research Institute and the State Geological Institute. There has been a low level of co-operation and synchronisation of activities between main actors for a long time.

A major step was taken in 2013 towards the more effective co-ordination of STI policies by adopting the *Smart Specialisation Strategy of the Slovak Republic*. This document represents a consensus created with the participation of scientists, entrepreneurs, business clusters, regional government structures, civil society structures and advice from foreign European Commission experts.

The Smart Specialisation Strategy is defining a new setup of a new STI policy governance system. The key authority for managing the implementation of RIS3 is the Government Council for Science, Technology and Innovation. The Standing Committee of the Government Council for Science, Technology and Innovation will be established as a working body of the key authority. Other ministries and central state administration bodies will also be involved in this process. The existing network of implementation agencies will be transformed into two independent ones: the Research Agency and Technological Agency. They will come under the area of competence of MESRaS and ME SR and will be guided by the SC GCSTI to ensure RIS3 implementation.

## 5.2 Evaluation

Evaluations are useful tools to improve the effectiveness of public policies by assessing the efficacy, efficiency, relevance, utility and durability of policy instruments. However, the evaluation of STI

policies had not been regular practice in the Visegrad countries. A major change has started in that respect given the EU regulations that all the instruments co-financed by the EU Structural Funds need to be evaluated.

In the Czech Republic an annual report entitled "*Analysis of the R&D&I status in the Czech Republic and its international comparison in … (year)*" is prepared by the Research, Development and Innovation Council. Background reports are prepared by the Technology Centre of the Czech Academy of Sciences in co-operation with the Czech Statistical Office. The analysis represents a comprehensive overview of the available RTDI statistics and also includes a qualitative commentary about important trends. However, it is not supposed to assess the effectiveness of policies.

At programme level, the internal evaluation of outcomes is carried out by the providers of public funding themselves. This exercise therefore only provides a summary of the invested financial capital and the number of relevant outputs. It is not possible to assess the benefits of these outputs and their long-term effects. As a result, the evaluation fails to fulfil its task and the outputs cannot be used to support strategic decision-making.

Recently, more attention is being paid to analyses of Czech RTDI performance. These analyses are usually commissioned by the RDI Council, ministries or other organisations engaged in implementing different programmes. Some of these analyses provide an in-depth look into R&D issues, thereby revealing causality or identifying excellent performers in the public or corporate sector. Funding agencies have also started to realise their responsibility in the systematic evaluation of the outcomes of the programmes they administer. Gradually, a significant analytical background is created, which will provide support for informed decision-making.

In the future, the evaluation exercise should be more methodologically unified because the latest version of the STI Policy, approved in 2012, includes a set of indicators for each measure. The performance will be monitored on the basis of these indicators. The overall policy evaluation falls within the responsibilities of the RDI Council that will assign the processing of particular in-depth evaluation studies.

As for the nationally funded Hungarian 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 be regularly evaluated by independent experts. Based on this law, Government Decree no. 198/2005 specifies the type of measures to be evaluated ex-post. As a general rule, one-off schemes of more than HUF 1 bn (€ 4 m at that time) are to be evaluated within 3 years following the completion of the scheme, whereas continuous programmes (with cumulated funding of over HUF 1 bn) are to be evaluated within 2 years of the end of the given programme cycle. For continuous programmes, irrespective of the volume, an ex-post evaluation is compulsory within 4 years of the launch of the first call. Despite these stipulations, only four external evaluations have been conducted. In accordance with EU regulations, schemes co-funded by EU Structural Funds have to be evaluated (ex-ante, mid-term and ex-post).

The main act concerning the rules for evaluating public policies (including innovation policy) in Poland is *The act on the principles of development policy* of 2006. Initially, the ex-ante evaluation was only mandatory for SF operational programmes. The amendments to the Act adopted in September 2014 extended the scope of the act to include a requirement to evaluate national development programmes. In both cases it relates to programmes which exceed the budget of PLN 300 m. (€ 70 m.).

The evaluation system is co-ordinated by the National Evaluation Unit of the Ministry of Infrastructure and Development. The Unit collaborates with evaluation divisions in other ministries and at regional level with the Voivodship boards. Although the network of evaluation units is well-developed, evaluations are not fully internalised by management processes but rather as a response to formal, external requirements.

An assessment of the research programmes in Slovakia is performed by the Ministry of Education, Science, Research and Sports and its agencies, as well as the Ministry of Economy and its respective agencies. Evaluation reports analyse the planned and actual results of research projects, and calculate financial indicators related to the supported activities. Evaluation reports are published on the ministries' websites. The Structural Fund schemes are evaluated on a continual and periodical basis. The monitoring reports related to individual calls and the annual reports for particular Operational Programmes tend to be rather formal. They concentrate on specifying the number of applicants, together with the amount of support required and awarded.

The Ministry of Education, Science, Research and Sports has published its annual reports on research and development since 2005, in order to provide an evaluation of the Slovak research and development system. It includes, for example, an analysis of the projects supported by the Research and Development Agency and grant agencies, as well as an overview of research and development activities co-financed by the Structural Funds. The Slovak government has published annual evaluation reports on the Innovation Strategy 2007 – 2013 and Innovation Policies. A specific impact assessment is, however, missing from these reports. The Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (RIS3 SK) should create an effective evaluation system, focussing on measuring the impact of R&D institutes, based on both economic and social variables.

## 5.3 Foresight

Hungary launched its first Technology Foresight Programme (TEP) in 1997, which was also the first of its kind in Central and Eastern Europe. TEP was a national foresight (futures studies) programme, covering seven broad thematic fields. It started out looking at socio-economic needs, that is, not scientific and technological issues *per se*. The overall objective of TEP was to contribute to a strategy for a socially, economically, and environmentally sustainable development.[15] The final reports, including policy recommendations, were discussed by parliamentary committees, and were favourably received. The TEP has been evaluated by an international panel of experts, and their report is publicly available. (Georghiou et al., 2004).

Although one of the tasks of the National Office for Science and Technology (NORT) – renamed as National Innovation Office in January 2011 – is to conduct foresight activities, no national foresight programme has been launched since the completion of TEP.[16]

A similar situation can be observed in the Czech Republic, where some critical technology exercises have been completed, but technology foresight is not a regular activity. The first relevant activity – a critical technology project with foresight elements – was conducted in 2001 to identify priorities for the new "National Programme for Oriented Research" and to devise a suitable method of implementing and managing the new programme. The results were achieved by the broad co-operation of several hundreds of leading representatives from academia, business, finance, state administration and other organisations working in panels and expert groups. Panel discussions were complemented by thorough SWOT analyses of key industrial sectors.

The second exercise was realised in 2011-2012 to prepare new National Priorities for Oriented Research, Experimental Development and Innovation. This was the responsibility of the RDI Council. This process was not called a technology foresight project, although it had similar methodological features. In the first phase of this process, outlook studies were prepared to identify the main issues for the next 15-20 years. In the second phase experts from both the public and private sectors were included. An Expert Co-ordination Council, based on the outlook studies, identified six priority areas

[15] For further details on the methods, processes and results of TEP see, e.g., Havas, 2003.

[16] This government decree establishing it was issued in 2004. As the TEP reports were completed in 2000 (published in printed form in 2001), in an ideal case the third Hungarian foresight programme would already have been completed by now.

that were discussed and approved. In the next phase expert panels were set up to further analyse these priority areas.

To date, 47 foresight projects have been prepared in Poland, of which 22 had a regional character. The first regional foresight projects were prepared in 2005 for different Voivodeships (regions), financed by EU funds (the 6$^{th}$FP and Operational Programmes). As the concept of foresight became more popular, new more specific projects were realised such as the foresight project for nano-technology in Podlaskie Voivodship, the foresight project for materials technologies in Aviation Valley or the foresight project for Higher Schools in Mazovian Voivodship (Nazarko, 2013).

At country level, two major foresight projects were prepared, namely *Foresight Poland 2020* and *InSight 2030*. The former was initiated in 2006 and aimed at designing scenarios (5 scenarios ranging from the most pessimistic to the most optimistic) for the development of Poland. It provided analysis in three layers – sustainable development, information as well as telecommunication technologies and security.

The main Polish national technology foresight programme for industry – *InSight 2030* – was prepared in 2010. Within the 10 research fields assessed, 35 competitive areas were chosen to have the highest added value for socio-economic development. Furthermore, 127 key technologies were outlined, among which 34 were prioritised for being particularly attractive (in view of global commercial success). Each of the 34 technologies were further analysed and 34 roadmaps were created to plan their development and commercialisation.

In 2012 the results of the foresight project *InSight 2030* became the subject of a two-stage public consultation. Different organisations representing business (in contrast to scientific organisations responsible for managing the project) discussed the importance and prospects of the chosen technologies. As a consequence, the Ministry of Economy, which is responsible for the whole process has modified the list of key technologies. The update is to be repeated on a yearly basis and an evaluation of foresight projects carried out every 5 years. The results of the foresight project *InSight 2030* form the basis for various strategic government documents such as the *Enterprise Development Programme 2020* and *Smart specialisation strategy*.

Currently there is no technology foresight programme in Slovakia. The Slovak Innovation and Energy Agency plans to introduce a complex foresight programme, similar to the Hungarian one.

## 5.4 Policy advice and consultation

National Academies of Science exist in all V4 countries and are entitled to consult about STI policies. The academies are public organisations, with their own network of research institutes, with self-governing rights asserted by the assembly and executive body, headed by the President. Their main tasks are to develop, promote and represent science, as well as to report on developments in scientific research. Examples of their contribution to policy-making activities may be the involvement of the Hungarian Academy of Sciences (MTA) in the formation of major STI policy documents (e.g. the government's mid-term STI policy strategy for 2007-2013) or the co-ordination of the Polish *InSight 2030* project by the Polish Academy of Sciences.

Another important body which exists in all the V4 countries is the Rector's Conference. It is responsible for providing opinions and recommendations regarding all documents related to the higher education system. It also makes proposals for decision-makers or experts involved in preparing decisions.

Further policy advice in the V4 is provided by various organisations. In the Czech Republic, an international audit was carried as a part of the RDI system reform. The audit was commissioned by the Ministry of Education, Youth and Sport (MEYS) and provided by an international consortium led by Technopolis Group during 2010/11, with support from the Technology Centre of the Academy of

Sciences of the CR. The aim of the audit was to provide an independent evaluation of the Czech RDI system and to support decision-makers with relevant recommendations to enhance the quality and effectiveness of the national innovation system and to design the necessary measures and tools. This was one of the most comprehensive studies of its kind ever undertaken in the Czech Republic and involved not only examples of good practice from abroad but also specific recommendations for further development in such areas as public funding of R&D, policy governance, the evaluation methodology used in allocating institutional funding to organisations performing research or human resources in R&D.

In turn, a review of the national innovation system was performed by international experts of the OECD in Poland (2007) and Hungary (2008).

The Czech Research, Development and Innovation Council has established several advisory bodies: an Expert Commission for Life Sciences; Expert Commission for Technical Sciences and Engineering; Expert Commission for Humanities and Social sciences as well as a Bioethics Commission. These bodies prepare proposals and recommendations for the long-term focus of STI policy, express their views concerning all the organisational and professional aspects of the national innovation system and give their opinion during the preparation of the national RDI programmes.

A similar organisation exists in Slovakia. The Government Council for Science, Technology and Innovation includes representatives of ministries, the Slovak Academy of Sciences, the Slovak Rectors' Conference, the Office of Nuclear Regulatory, Higher Education Council, entrepreneurs and other experts.

No such body exists in Poland, although the Polish Ministry of Science and Higher Education has created around 40 consultation bodies, among which the most important is the Main Council for Science and Higher Education. The Council collaborates with the relevant public administration bodies on policies related to higher education, science and innovation. Other important consultation bodies are responsible for such issues as good practices at universities, young scientists, the evaluation of scientific units or international co-operation.

Hungarian universities, research institutes and chambers of commerce were represented in the Higher Education and Research Council, advising and assisting the Secretary of State for Education (at the Ministry of Human Resources) in tasks and decisions related to higher education and academic research. The Council was dissolved in February 2012. Its successor, called Higher Education Planning Council, was set up in April 2012.

The permanent expert, advisory, initiative and co-ordination body of the Slovak government for STI policy issues is the Government Council for Science, Technology and Innovation (it replaced the Government Council for Science and Technology that was in place from 2006-2012). The government also consults drafts of laws and regulations on science and technology policy with the Association of Industrial Research Institutes and employers' associations.

# 6 Conclusions

The most widespread definition of innovation, formulated by the OECD in the third Oslo Manual, and also used by the European Commission services, needs to be extended. Recent results of innovation studies have shown the importance of previously eclipsed types of innovation, such as public sector innovation, social innovation and user innovation.

Looking at the main EU innovation monitoring and ranking tool, the Innovation Union Scoreboard, its focus on R&D based innovation is evident. It is reinforcing the linear model of innovation, in which the focus is on science-based, breakthrough product innovations. Consequently, the so-called DUI mode of innovation, based on *learning by doing, using and interacting*, is considered to be of secondary importance.

Knowledge about innovation processes and performance should form the basis for defining the policy rationale of STI policies. However, the STI policy rationale is not explicitly expressed in the Visegrad countries. Implicit justifications for government interventions are usually based on the market failure argument, that is, tend to follow the science-push (linear) model of innovation. Traditionally, they concentrate on supply side policies (aimed at supporting R&D activities) and supplement them (rather modestly) with instruments strengthening the demand for innovation.

The STI policy instruments used in the Visegrad countries share a considerable similarity across these four countries, as well as with those used in other EU member states: they largely correspond to the traditional approach to innovation. Following this logic, some obvious weaknesses can be noted, however, in particular the lack of effective tax incentives for innovation in Poland or lack of PE/VC schemes in Slovakia. From a different angle, the Beta Programme (Czech Republic), various business-academia co-operation schemes (Hungary), the Top 500 Innovators (Poland), and E-procurement (Slovakia) are good examples of instruments, which can be mutually inspiring. Yet, the need for further schemes based on the DUI mode of innovation is particularly important in the Visegrad countries where improved productivity and higher quality standards are more urgent means to enhance international competitiveness in the short- and medium-run than breakthrough product innovations.

Responsibilities for STI policy-making are typically divided between ministries responsible for the economy and for and higher education and science. Competition between these ministries and their subordinate agencies may have a stimulating effect but it could also lead to conflicting actions. Better co-ordination of policy actions through high-level bodies and the further orchestrating of the instruments is certainly necessary.

The use of tools for policy preparation in the Visegrad countries leaves a large room for improvement. The most urgent action would involve promoting regular evaluation activities, which are clearly different from the control system in public administration. Various fora and channels for regular consultations between stakeholders and the government, both on short-term and strategic issues – for the latter using foresight methods, too – need also be created.

Improving innovation performance of the V4 will require more in-depth studies on the sources of innovation and its different kinds. This knowledge should be the foundation for the innovation policy rationale and reflected in strategic documents. The current STI policy mixes should be then amended accordingly. Such steps will help the V4 improve its technological and non-technological innovation capacities. That is certainly needed if domestic firms if the V4 countries are to move upwards in the international innovation and production networks.

# References


Arnold, E. (2011 October) *International Audit of Research, Development & Innovation in the Czech Republic. Final Report. Synthesis Report*, Brighton: Technopolis Group.

Aslesen, H.W., Isaksen, A., & Karlsen, J. (2012). Modes of Innovation and Differentiated Responses to Globalisation—A Case Study of Innovation Modes in the Agder Region, Norway. *Journal of the Knowledge Economy*, 3(4), 389–405.

ÁSz. (2008a). Jelentés a gazdaságfejlesztés állami eszközrendszere működésének ellenőrzéséről (Report on the audit on the operation of government tools for economic development). Budapest: Állami Számvevőszék (State Audit Office).

ÁSz. (2008b). Jelentés a Kutatási és Technológiai Innovációs Alap működésének ellenőrzéséről (Report on the audit of the financial management of the Research and Technological Innovation Fund). Budapest: Állami Számvevőszék (State Audit Office).

Carlsson, B., & Stankiewicz, R. (1991). On the nature, function and composition of technological systems. *Journal of Evolutionary Economics,* 1(2), 93–118.

Chaminade, C., & Edquist, Ch. (2006). *Rationales for public policy intervention from a systems of innovation approach: the case of VINNOVA*, Paper no. 2006/04, Lund University.

Chen, J., Chen, Y., & Vanhaverbeke, W. (2011). The influence of scope, depth, and orientation of external technology sources on the innovative performance of Chinese firms. *Technovation,* 31(8), 362–373.

Cooke, P., Uranga, M. G., & Etxebarria, G. (1998). Regional systems of innovation: an evolutionary perspective. *Environment and Planning A*, 20(9), 1563–1584.

Dosi, G. (1982). Technological paradigms and technological trajectories: a suggested interpretation of determinants and directions of technical change. *Research Policy*, 2(3), 147–162.

Eichengreen, B., Donghyun, P., & Kwanho, S. (2011). When fast growing economies slow down: International evidence and implications for China, *NBER Working Paper* No. 16919.

Ernst & Young and GKI. (2010a). Comprehensive assessment study about the operation of the Research and Technology Innovation Fund (KTIA), 01.01.2004 - 31.12.2009 – Executive summary.

Ernst & Young and GKI. (2010b). A Kutatási és Technológiai Innovációs Alap 2004.01.01. – 2009.12.31. közötti működésének átfogó értékelése (Comprehensive assessment study about the operation of the Research and Technological Innovation Fund (KTIA), 01.01.2004 - 31.12.2009).

European Private Equity and Venture Capital Association. (2014). *Central and Eastern Europe Statistics 2013 report*. Brussels.

European Commission. (2010). *Europe 2020: A strategy for smart, sustainable and inclusive growth*. Brussels.

Fagerberg, J., & Verspagen, B. (2009). Innovation studies: The emerging structure of a new scientific field. *Research Policy,* 38(2), 218–233.

Freeman, C. (1987). *Technology policy and economic performance: Lessons from Japan.* London: Pinter.

Gadomski, W. (2014, March 17). Miliardowe straty stoczni. Skąd się biorą kłopoty państwowych firm. *Gazeta Wyborcza.*

Gault, F. (2014). *Where are innovation indicators, and their applications, going?* Maastricht: UNU-MERIT Working Paper Series, 055.

Georghiou, L., Acheson H., Cassingena Harper, J., Clar G., & Klusacek K. (2004). *Evaluation of the Hungarian Technology Foresight Programme (TEP)*. Report of an International Panel. Manchester: PREST, University of Manchester.

Grzegorczyk, E. (2013). Funkcjonowanie kapitału private equity/venture capital w Europie na przełomie pierwszej i drugiej dekady XXI (Functioning of the PE and VC in Europe at the turn of the first and second decade of XXI century). In Harasim, J., & Frączek, B., (Eds.): *Innowacje w bankowości i finansach*, *Studia Ekonomiczne, Zeszyty Naukowe Wydziałowe Uniwersytetu Ekonomicznego w Katowicach*, 174, 277–290.

Hebáková, L., Vanžura, J., Kostić, M. (2011). *ERAWATCH Country Reports 2011: Czech Republic*. Prague: Technology Centre ASCR.

Havas, A. (2009). Magyar paradoxon? A gyenge innovációs teljesítmény lehetséges okai, *Külgazdaság*, 53 (9-10), 74–112.

Havas, A., & Nyiri, L. (2007). National system of innovation in Hungary: Background report for OECD Country Review 2007/2008, Budapest: National Office of Research and Technology.

Havas, A. (2014a). Trapped by the High-tech Myth: The need and chances for a new policy rationale. In Hirsch-Kreinsen, H., & Schwinge, I. (Eds.), *Knowledge-Intensive Entrepreneurship in Low-Tech Industries* (193–217). Cheltenham: Edward Elgar.

Havas, A. (2014b). The persistent high-tech myth and its implications for the EU10 countries, GRINCOH Working Paper.

Hirsch-Kreinsen, H., Jacobson, D., & Laestadius, S. (Eds.) (2005). *Low Tech Innovation in the Knowledge Economy*. Frankfurt: Peter Lang.

Jeck, T. (2012). Ekologické inovácie: teoretické a hospodárskopolitické súvislosti. *Working papers [EÚ SAV]*, 2012, 42, 1-28.

Jensen, M.B., Johnson, B., Lorenz, E., & Lundvall, B-A. (2007). Forms of knowledge and modes of innovation. *Research Policy*, 36(5), 680–693.

Klevorick, A.K., Levin, R.C., Nelson, R.R., & Winter, S.G. (1995). On the sources and significance of interindustry differences in technological opportunities. *Research Policy*, 24(2), 185–205.

Kline, S.J., & Rosenberg, N. (1986). An Overview of Innovation. In Landau, R. & Rosenberg, N. (Eds.), *The Positive Sum Strategy: Harnessing Technology for Economic Growth* (275–305). Washington: National Academy Press.

K-Monitor Public Association (2012). *Transparency and accountability in public procurement. The case of Visegrad Countries. Final Report.*

Lundvall, B-A. (Ed.) (1992). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London: Pinter.

Lundvall, B-Å. (1988). Innovation as an interactive process: from user-producer interaction to the national system of innovation (349–369). In Dosi, G. et al. (Eds.), *Technical Change and Economic Theory*, London: Pinter.

Lundvall, B-Å., & Borrás, S. (1999). *The Globalising Learning Economy: Implications for Innovation Policy*. Luxembourg: Office for Official Publications of the European Communities.

Malerba, F. (2002). Sectoral systems of innovation and production. *Research Policy*, 31(2), 247–264.

National Training Fund. (2011). *Mapa výzkumného a aplikačního potenciálu Česka: Situace na trhu práce: nabídka a poptávka po pracovnících ve vědě a výzkumu*. (The map of the research and application potential of the Czech Republic: Labour market situation: supply and demand for workers in science and research). Prague: Office of the Government of the Czech Republic.

Nazarko, J. (2013). Regionalny foresight gospodarczy. Metodologia i instrumentarium badawcze (Regional economic foresight. Methodology and research instruments). Warszawa: Związek Pracodawców Warszawy i Mazowasza.

Nelson, R.R., & Winter, S.G. (1982). *An Evolutionary Theory of Economic Change*. Cambridge, MA: The Belknap Press of Harvard University.

OECD (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data* (3rd ed.). Paris: OECD.

OECD (2008). *OECD Reviews of Innovation Policy: Hungary*. Paris: OECD.

OECD (2009). 2009 Interim Report on the OECD Innovation Strategy. An agenda for policy action on innovation

Kowalewska, A., & Szut, J. (2013). Nowe podejście do zamówień publicznych. Raport z badań 2013 (New approach to the public procurement. Research report 2013), Warszawa: Polska Agencja Rozwoju Przedsiębiorczości.

Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy*, 13(6), 343–373.

Salamon, L.M. (2002). *The tools of government: A Guide to the New Governance.* Oxford: Oxford University Press.

Schumpeter, J.A. (1942). *Capitalism, Socialism, and Democracy*, New York: Harper.

Vedung, E. (1998). Policy instruments: typologies and theories. In Bemelmans-Videc, M.L., Rist, R.C., & Vedung, E. (Eds.), *Carrots, Sticks and Sermons. Policy Instruments and Their Evaluation*, London: Transaction Publishers.

von Hippel, E. (1988). *The sources of innovation*. Cambridge, MA: MIT Press.

## Government Documents

## Czech Republic

Office of the Government of the Czech Republic. R&D&I Council. (2014). *Analysis of the existing state of R&D&I in the Czech Republic and a comparison with the situation abroad in 2013.* Prague.

Office of the Government of the Czech Republic. (2013). *National Reform Programme of the Czech Republic 2013: Growth – Competitiveness – Prosperity*. Prague.

Ministry of Industry and Trade. (2012). *Back to the Top. The International Competitiveness Strategy for the Czech Republic 2012 – 2020*. Prague.

Ministry of Education, Youth and Sports. Ministry of Industry and Trade. (2011). *Národní inovační strategie České republiky.* (National Innovation Strategy of the Czech Republic). Prague.

Office of the Government of the Czech Republic. R&D&I Council. (2013). *Národní politika VaVaI v ČR na léta 2009 až 2015 s výhledem do roku 2020.* (The National Policy of Research, Development and Innovations for the period 2009-2015 with an outlook to 2020). Prague.

Office of the Government of the Czech Republic. R&D&I Council. (2012). *The National Priorities of Oriented Research, Experimental Development and Innovations.* Prague.

## Hungary

Government of Hungary. (2007). *The Government's mid-term (2007-2013) science, technology and innovation policy (STI) strategy*. Budapest.

Ministry for National Economy. (2013). *Investment in the future: National Research and Development and Innovation Strategy (2013-2020).* Budapest: National Innovation Office.

## Poland

Chancellery of the Prime Minister. (2013). *The Long-term National Development Strategy 2030: Third Wave of Modernity.* Warsaw.

Ministry of Economy. (2000). *Increasing the innovativeness of the Polish economy up to 2006*. Warsaw.

Ministry of Economy. (2006). *Guidelines for increasing economic innovativeness for 2007-2013*. Warsaw.

Ministry of Economy. (2013). *Strategy for Innovation and Efficiency of the Economy: "Dynamic Poland 2020"*. Warsaw.

Ministry of Economy. (2014). *Enterprise Development Programme 2020*. Warsaw.

Ministry of Regional Development. (2006). *National Development Strategy 2007-2015*. Warsaw.

Ministry of Regional Development. (2012). *National development strategy 2020. Active society, competitive economy, efficient state.* Warsaw.

National Research and Development Agency. (2011). *National Research Programme.* Warsaw

## Slovakia

Ministry of Education, Science, Research and Sport of the Slovak Republic. (2000).*Concept of the State Science and Technology Policy in 2005*. Bratislava.

Ministry of Education, Science, Research and Sport of the Slovak Republic. (2007). *Long-term Plan for the Science and Technology Policy of the Slovak Republic by 2015*. Bratislava.

Ministry of Education, Science, Research and Sport of the Slovak Republic. (2011). *Update the long-term objective of the state science and technology policy in 2015 - Strategy Fenix*. Bratislava.

Ministry of Education, Science, Research and Sport of the Slovak Republic and Ministry of the Economy of the Slovak Republic. (2013). *Research and Innovation Strategy for Smart Specialisation of the Slovak Republic*. Bratislava.

Ministry of the Economy of the Slovak Republic. (2007). *Innovation Strategy of the Slovak Republic for 2007-2013*. Bratislava.

Ministry of the Economy of the Slovak Republic.(2008). *Innovation Policy of the Slovak Republic for 2008-2010*. Bratislava.

Ministry of the Economy of the Slovak Republic.(2011). *Innovation Policy for 2011 to 2013 within the framework of the Ministry of Economy of the Slovak Republic.* Bratislava.

Ministry of the Economy of the Slovak Republic.(2013). *Innovation Strategy of the Slovak Republic for 2014-2020.* Bratislava.

Ministry of Finance of the Slovak Republic. (2005). *Minerva 1.0*. Bratislava.

Ministry of Finance of the Slovak Republic. (2011). *Minerva 2.0*. Bratislava.