“Creating a conducive environment for higher competitiveness and effective national innovation systems. Lessons learned from the experiences of UNECE countries”

This *Comparative review* is compiled in the context of the programme of work of the UNECE Team of Specialists on Innovation and Competitiveness Policies (TOS-ICP), which is part of the programme of work of the UNECE Sub-programme on Economic Cooperation and Integration, as decided at the First meeting of TOS-ICP held in Geneva on 8-9 March 2007 and following the Outline agreed upon at that meeting. It draws on policy documents and other materials submitted to the UNECE by members of the TOS-ICP, as well as on other publicly available documents and materials.

A major substantive contribution to the *Review* by Slavo Radosevic, Professor of Industry and Innovation Studies, University College London, School of Slavonic and East European Studies, is gratefully acknowledged.

TABLE OF CONTENTS

INTRODUCTION

The increasing importance of knowledge and innovation for growth and competitiveness has raised the interest of governments in policies seeking to create a conducive environment for innovation generation and diffusion. Growth is the result not only of physical or human factor endowments, but also of social factors and processes as well as institutions. Traditional macroeconomic policies have shown to be insufficient to meet this objective. Macroeconomic stability is only one ingredient of an environment required for innovation. However, there are widely diverging opinions about the extent to which public policies should extend beyond the confines of the macroeconomic policy mix. In addition, there is a significant gap between theories of economic advice and the reality of policy practice. Also, the conditions for technological catching up are rapidly changing and the recipes of yesterday may not work any more. All this requires re-examination of policies that are considered as conducive to competitiveness and innovation, in particular.

There seems to be an emerging consensus that the institutional features of the economy exert significant influence on the country's innovative capability. Equally, it is acknowledged that the relationship between the country's institutional environment and the ability of national firms to innovate and compete is quite complex, containing numerous linkages, as well as direct and indirect feedback mechanisms. The understanding of this relationship is continuously improving but, at the same time, the increasingly global competition, the rapid technological advances and emerging new strategies at the firm and country levels makes this understanding only tentative and often obsolete. This increases the need for continuous stock-taking and reassessment of the established 'common wisdoms' in both policy and enterprise strategy.

The main objective of this *Comparative review* is to provide an overview of how governments in the UNECE member countries support innovation activities and how they try to maximise the benefits of that support for achieving higher economic growth and enhanced competitiveness. Specifically, the *Review* addresses the following issues:

- How policy makers in different countries determine objectives in innovation and competitiveness policies?
- Which policy instruments are commonly used in targeting innovation-based competitiveness?
- What are the main effects of innovation and competitiveness policies?

These are quite ambitious objectives in view of the time constraints for the compilation of the *Review*. In addition, the UNECE region is very heterogeneous in terms of the levels of economic development and the institutional traditions. Hence, the *Review* is by necessity confined to the more modest objective of highlighting a selected set of issues and best practices that could be useful to member countries for improving their policy making in this area. Moreover, in view of the diversity of the UNECE member states and the mandate of the UNECE Team of Specialists on Innovation and Competitiveness Policies (TOS-ICP), the analysis is mostly focused on the catching up economies of the UNECE region.[1] Yet, in terms

[1] Throughout this *Review*, the term "catching up economies" is used to define the group of ten new EU member states (NMS, namely, Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia), the countries of South-east Europe (SEE, namely, Albania, Bosnia and Herzegovina, Croatia, Montenegro, Serbia and The former Yugoslav Republic of Macedonia) as well as the countries of

of its geographic coverage, the *Review* includes also the developed market economies in the region. In this respect, the objective is to enhance transnational learning in innovation and competitiveness policies across the region, with a specific focus on the catching up UNECE economies.

The *Review* is structured as follows. Chapter 1 provides a necessary context within which the three key questions are addressed. Chapter 2 addresses issues related to the process of setting objectives in innovation and competitiveness policies. Chapter 3 overviews the range of policy instruments commonly used in targeting innovation-based competitiveness. Chapter 4 summarises the experiences related to the implementation of innovation and competitiveness policies and the evaluation of their effects.

Eastern Europe, Caucasus, and Central Asia (EECCA, namely Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan).

CHAPTER 1. THE INSTITUTIONAL FRAMEWORK OF INNOVATION AND COMPETITIVENESS POLICIES: NATIONAL INNOVATION SYSTEMS

Innovation and technology are systemic and economic (entrepreneurial) processes.[2] Innovation emerges from a continuous interaction between firms, their suppliers and buyers and external actors like universities or research and development (R&D) organizations. Firms are not isolated in their innovation activities but rather perform them in networks; these activities are highly dependent on the external environment at the sectoral, regional, and national levels. The term "national innovation system" (NIS) characterizes the systemic interdependencies within a given country, which influence the processes of generation and diffusion of innovation in that economy. In this respect, it is possible to distinguish between public support system to innovation, or *narrow* NIS, and framework conditions, or *broad* NIS[3].

The extensive ongoing research of the driving forces of the interrelated processes of innovation, competitiveness and economic growth increasingly points to the key role of institutions. Also, the results of empirical research tend to show that policies such as those of trade openness, macroeconomic stabilization policies, and exchange rate policy do not exert any independent effect on long-term economic performance once the quality of domestic institutions is taken into account.[4] An increasing focus on institutions lies at the core of the so called 'augmented Washington consensus'.[5] In many developed, as well as in an increasing number of catching up UNECE economies, policies for competitiveness and innovation have been driven by the NIS approach as a way to learn about the impact of organizations and institutions on national innovative activity.

With the advent of globalization, implying rapidly increasing production, trade, finance and technology linkages across nations, there has been an increasing concern that relevance of the NIS may have been diminished. A review of these issues suggests that globalization does *not* make local, regional or national systems redundant. On the contrary, such systems of innovation play a key role in the shaping of the global pattern of corporate technological activity.[6] A more nuanced view is that the innovative activities of firms are significantly influenced by their home country's national system of innovation but also national innovation

[2] Jan Fagerberg (2005), "Innovation: A Guide to the Literature", in Jan Fagerberg, David C. Mowery, and Richard R. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford: Oxford University Press, pp. 1-26.

[3] One broad definition of the national innovation system is 'the network of institutions in the public and private sectors whose activities and interactions initiate, import and diffuse new technologies'. Chris Freeman (1987), *Technology Policy and Economic Performance - Lessons from Japan*, London: Pinter Publishers. One can distinguish between the *narrow* NSI i.e. organizations and institutions involved in searching and exploring - such as R&D departments, technological institutes and universities, and the *broad* NSI, i.e., all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring – the production system, the marketing system and the system of finance represent sub-system in which learning takes place. Bengt-Ake Lundvall (ed.) (1992) *National Systems of Innovation - Towards a Theory of Innovation and Interactive Learning*, London: Pinter Publishers, p.2.

[4] William Easterly and Ross Levine (2003), "Tropics, Germs and Crops: How Endowments Influence Economic Development" *Journal of Monetary Economics*, Vol. 50, No. 1, pp. 3-39.

[5] Dani Rodrik (2006), "Goodbye Washington Consensus, Hello Washington Confusion? A Review of the World Bank's Economic Growth in the 1990s: Learning from a Decade of Reform", *Journal of Economic Literature*, Vol. 44, No. 4, pp. 973-987.

[6] Daniele Archibugi, Jeremy Howells and Jonathan Michie (1999), "Innovation Systems in a Global Economy", *Technology Analysis & Strategic Management*, Vol. 11, No. 4.

systems themselves are becoming internationalized, even if the institutions that support them remain country-specific.[7] There is an increasing internationalization of R&D activities as well as the emergence of new types of R&D, which go beyond the adaptive type. Equally, the adaptive R&D is still predominant, and technology generation activities are still centralised within the headquarters of transnational corporations (TNC).[8]

Technology and globalization co-evolve, that is they develop partly independently but also partly influencing each other, which inevitably is reflected in the evolution of the national systems of innovation.[9] As international production and technology is becoming more fragmented, it becomes ever more important how countries integrate in terms of trade, finance, production and technology. Catching up is essentially an endogenous process whereby the host country and its domestic technological capabilities are crucial determinants of the technology transfer. In the new globalised context, the core problem for technological catching up is how high-value inbound TNC activity and sourcing links are likely to be attracted into innovative and productive sectors and thus be embedded in a 'virtuous circle' of asset accumulation and clustering[10].

These processes occur in different national institutional contexts where the strategic behaviour of countries, large companies and technological and economic opportunities co-evolve in a complex fashion. Thus strategies that can convert opportunities for sourcing and the entry of foreign direct investors into highly specific national comparative advantages become the key to the technological catch-up. An important challenge facing countries is how to get connected in the most effective way with the global R&D networks of the TNCs. The ability of a country to benefit from the internationalization of R&D depends first and foremost on the strength of its NIS. The inward expansion of international production networks leads to structural changes in the NIS of the host country. These compositional and spillovers effects are also shaped by national policies.

Among the national policies that contribute to catching up, innovation policy is the only one that explicitly targets the innovation capabilities of the country. Innovation policy belongs to the broadly defined area of industrial policy, which also includes trade and competition policy. In its broad meaning, industrial policy is considered as the overall ensemble of policies that directly and indirectly affect industrial performance through its impact on microeconomic variables.[11] While these different aspects are closely interlinked, innovation policy has become the dominant, if not the major, dimension of industrial policy today. Increasingly, innovation policy has taken over some of the role of industrial policy as an approach to enhancing competitiveness, economic growth and structural adaptation.[12]

---

[7] Bo Carlsson (2006), "Internationalization of Innovation Systems: A Survey of the Literature", *Research Policy* Vol. 35, No. 1, pp. 56–67.

[8] UNCTAD (2006), *World Investment Report 2005: Transnational Corporations and the Internationalization of R&D*, New York and Geneva: United Nations.

[9] Rajneesh Narula (2003), *Globalization and Technology*, Cambridge: Polity.

[10] Slavo Radosevic (1999), *International Technology Transfer and 'Catch Up' in Economic Development*, Cheltenham: Edward Elgar.

[11] Thomas M. Jorde and David J. Teece (1992), "Innovation, Cooperation and Antitrust". In Jorde, T., Teece, D. (eds.) *Antitrust, Innovation and Competitiveness*. New York: Oxford University Press, pp. 47-81.

[12] As pointed out by Rodrik, 'contrary to general belief, the last two decades have seen a tremendous amount of industrial policy. …. Incentives and subsidies have been refocused on exports and direct foreign investment'. Dani Rodrik (2004), "Industrial Policy for the Twenty-First Century", CEPR Discussion Papers No. 4767,

In a traditional perspective, industrial policy used to be focused on national champions (in fact, being in conflict with competition policy), its traditional focus being on static attributes like large scale and/or higher market concentration.[13] This version of industrial policy has been largely abandoned in most countries as it does not correspond to the changing conditions of increasing global interdependence and the systemic nature of new technologies. A broader definition of industrial policy encompasses both competition policy and innovation policy as its parts.[14] In its mainstream version, broad industrial policy comprises micro based policies focused on the background conditions for competition, on the improvement of the investment climate and the reduction of market failures and distortions. It could be characterised as a broad micro policy which seeks to identify and reduce impediments in the environment for competitiveness and growth.[15]

The UNECE region includes a wide variety of economies at very different levels of their innovative capability. Their growth is based on different degrees of importance of the basic factors of competitiveness, of efficiency enhancers and innovation factors.[16] In terms of innovation, their growth is based on different degrees of 'imitation' and/or 'innovation' activities. On that basis, it is often assumed that due to the public nature of knowledge, countries that are behind the technology frontier can enjoy the advantages of free knowledge through imitation and import at reduced prices.

However, 'latecomer advantages', which supposedly arise from mere imitation of already available technologies whose knowledge base is free, are rare. Catching up is not just a process of mere imitation; it requires adaptation and innovation proper.[17] Successful catching up has historically been associated not just with the adoption of existing techniques in established industries within a different environment, but also with innovation, particularly of the organizational kind, and with inroads into nascent industries.[18] If the scope for imitation were so large there would have been many more cases of convergence and catch up with developed economies. In reality, the potential for diffusion/imitation in the developing countries is more than counteracted by more efficient financial systems, better governance

---

London: Centre for Economic Policy Reform. In addition, there has been (both in developed and in catching up economies) an increasing expansion of innovation policy.

[13] This is basically a somewhat misleading extrapolation from Asian experiences (such as those of Japan, Korea). In this view, import-substituting industrialization was basically the strategy of encouraging domestic industry by limiting the imports of manufactured goods.

[14] This understanding of industrial policy has its origin in the neo-Schumpeterian view of competition whose purpose is to ensure dynamic selection (competition policy) and generation of variety (innovation policy).

[15] Thus its application as a general micro competitiveness policy is actually widely accepted nowadays. For example, the idea of micro competitiveness (based on Michael Porter's views) as approached in the World Economic Forum Global Competitiveness Reports (WEF GCR) and its policy focus on clusters, linkages and regulatory aspects of competitiveness could be considered as mainstream industrial policy of today.

[16] In terms of WEF (2006), *The Global Competitiveness Report 2006-07: Creating an Improved Business Environment*, Palgrave-Macmillan, London.

[17] Jan Fagerberg and Bart Verspagen (2003), "Innovation, Growth and Economic Development: Why Some Countries Succeed and Others Don't", Paper prepared for the First GLOBELICS Conference 'Innovation Systems and Development Strategies for the Third Millennium', Rio de Janeiro, November 2-6, 2003.

[18] Jan Fagerberg and Manuel M. Godhino (2005), "Innovation and Catching-Up", *The Oxford Handbook of Innovation*, Oxford: Oxford University Press.

and faster growth of knowledge in other countries.[19] As a result, technology gaps can be not only exploited through imitation, but also created through innovation. Hence, the capability to innovate and thus the importance of science for catching up remain essential. In this respect, differences between countries at the technology frontier and those catching up are important but they are probably not qualitatively different. This opens a larger room for transnational learning than would follow from the traditional sharp distinction between 'innovators' and 'imitators'. From this point of view, one of the potential niches for the UNECE could be to facilitate this type of transnational learning and spread of good practices in innovation policy.

Historical experience suggests that public investments in R&D have been a central component of economic catch up strategies for the past 125 years.[20] The importance of the knowledge related capabilities in the 21st century is more likely to increase.[21] An important lesson from the historical analysis of catch up is the overwhelming importance of the institutional context and specific conditions rather then policy principles. What matters is the implementation and institutional system, which can ensure autonomy and relevance of R&D for the economy but also linkages and synergies to the global economy. In the current World Trade Organization (WTO)-dominated institutional regime, the need for public R&D investments to complement market oriented development strategies has actually increased. An institutional system that nurtures openness, but which also fosters technology-based competition, is the key aim of nation states. This interaction occurs through sector-specific and sometimes even firm-specific networks and innovation systems. Hence, the access to global networks and the ability to participate in these networks is essential to competitiveness and economic growth. In terms of policy, this expands the traditional concern with the market failure rationale for supporting R&D with a variety of new types of failures, which are endemic to the systems of innovation. These are, for example, capability failures in the business sector, failures in institutions, network or system failures and framework failures or failures in regulatory systems.[22]

Are there common structural weaknesses of the national innovation systems in the catching up UNECE economies? On the basis of previous research it is possible rather tentatively to outline several such common weaknesses:

- Innovation activity is restricted to a few large domestic enterprises which invest comparatively high shares of their revenue into innovation.
- Small and medium enterprises (SMEs) are the weakest part of the national innovation system as demonstrated by a very small share of innovative SMEs.

[19] Jan Fagerberg and Martin Srholec (2005), "Catching up: What Are the Critical Factors for Success?", Centre for Technology, Innovation and Culture, University of Oslo, Working Papers on Innovation Studies No. 0401.

[20] David C. Mowery (2005), "The Role of Knowledge-Based 'Public Goods' in Economic 'Catchup': Lessons from History", *Industrial Development Report 2005 Background Paper Series*, Vienna: UNIDO

[21] For example, it has been argued that 'the role of indigenous public research is more important today than it was in the 20th century'. See Richard R. Nelson (2005), "The Roles of Research at Universities and Public Labs in Economic Catch-up", In Grazia D. Santangelo (ed.), *Technological Change and Economic Catch-up. The role of Science and Multinationals*. Cheltenham: Edward Elgar, p. 19. This author points to the changing conditions for catching up which lie primarily in the increased importance of indigenous capabilities in R&D and, in particular, the increasingly important roles of indigenous universities and public laboratories as vehicles for technology transfer.

[22] Erik Arnold (2004), "Evaluating Research and Innovation Policy: A Systems World Needs Systems Evaluations", *Research Evaluation*, Vol. 13, No. 1, pp.3-17.

- Foreign firms are investing comparatively more into R&D and innovation than domestic firms. In addition, the productivity gap between domestic and foreign firms is still significant, leading to a dual economy syndrome.
- There are very weak linkages between domestic large and small firms, and weak horizontal links between FDI and domestic firms. However, vertical links, especially value chain based links, between foreign and local firms are strong. This creates a duality of fragmented national innovation systems and increasingly production and value chain based integration of these economies into the global economy. This primarily applies to the NMSs and less so to the EECCA economies.
- High productivity improvements, which have been recorded in the catching up economies in the last 10 years, are based on improved production capability (and this partly lies behind the recorded high productivity growth) while the technology/R&D capability remains weak.

From innovation and competitiveness policy perspective, the major weaknesses of the NIS in the catching up UNECE economies are in the 'broad' rather than in the 'narrow' NIS.[23] These economies have lower levels of productivity than would be expected given their R&D capacities, innovation and production capabilities. This may point to possible inefficiencies in the conversion of R&D and innovation outputs into productivity. These inefficiencies cannot be identified within the 'narrow' national system of innovation but more likely within 'broad' national system of innovation. In particular, there are problems in the broader demand for technology. For example, studies on Russia suggest that '… in general, Russia performs best on international comparative innovation indices when they are weighted towards inputs into R&D; it performs less well on indices that emphasise revealed technical achievement; and it ranks worst of all on indices emphasising economic incentives'.[24]

The policies of economic transformation that prevailed in the catching up UNECE economies during the 1990s were generally insufficient for building well functioning 'narrow' NIS, which in all countries are hybrid systems and require public-private cooperation. The dominant stance in most of these economies has been radically to reduce public funding but without a clear idea of what the new public R&D system should look like. A wait-and-see policy on the 'narrow' NIS, especially in relation to industrial R&D, has become counterproductive because of the costs incurred. This has been understood with some delay in most of the catching up economies. In the NMSs, the EU accession itself has pushed these countries towards establishing targeted innovation policies and towards increasing concern with the competitiveness agenda. This came partly as a result of an increasing awareness that their competitiveness may be undermined once they become full members of the EU but it has also been a result of the EU requirements whereby countries had to demonstrate that they are able to withstand the competitive pressures of the Single Market. In the EECCA countries, the recovery and growth after 1998 has contributed to an increasing awareness that avoiding resource dependency and promoting innovation are the ways forward. This policy activism has been especially pronounced in Russia and Kazakhstan.

[23] Slavo Radosevic (2005), "Are Systems of Innovation in Central and Eastern Europe Inefficient?" Paper presented at the DRUID Tenth Anniversary Summer Conference 2005 on 'Dynamics of industry and innovation: organizations, networks and systems', Copenhagen, June 27-29, 2005. http://www.druid.dk/uploads/tx_picturedb/ds2005-1457.pdf

[24] Christian Gianella and William Tompson (2007), "Stimulating Innovation in Russia: The Role of Institutions and Policies", *OECD Economics Department Working Papers*, No. 539, Paris: OECD.

The renewed activism in promoting innovation and the increasing concern with competitiveness have led to a search for policy responses in most catching up economies. This shift occurred in parallel with the renewed criticism of the 'Washington Consensus' policies and the emergence of the 'augmented Washington consensus'; more generally, with a more pragmatic search for new policy solutions. The demand for policies that promote innovation in the NMSs has been reinforced with EU membership, where policy is being more and more implemented as a pan-European task. As a result, in all NMSs, in some EECCA (Russia, Ukraine, Kazakhstan) and SEE countries (Croatia, among others), a wide portfolio of innovation policy instruments has been introduced. The current period could be characterised as a period of intensive learning in innovation policy, in particular, of transnational learning as well as a period of certain convergence of innovation polices across the region.

Such a trend is present in the convergence of the conceptual approaches to the systems of innovation and in the increasing complexity of the policy mix. The existing range of long-standing R&D instruments is expanding with additional financial instruments and links to complementary policies (regulatory, educational, etc.). Within the EU, this convergence is driven in part through the Open Method of Coordination which has effects on the way in which EU member countries are constructing their national policy mixes.[25]

As noted, the UNECE region includes countries at very different levels of their innovative capability. If one takes the ranking of innovation capability as measured by the EU Global Innovation Scoreboard index, one finds the UNECE countries along the entire spectrum of this scale.[26] This limits the scope of a potential wide-ranging comparative analysis and therefore the present *Review* is mostly focused on the catching up UNECE economies. A common structural feature of these economies is their greater reliance on imitation than on world frontier innovation for economic growth and catching up.

This orientation of the technological effort within a country is directly reflected in the emergence of an 'innovation constituency' or organizations and institutions that implicitly or explicitly promote innovation. A common feature of most catching up economies has been a generally weak and disorganized constituency in favour of innovation policy and innovation activities. Innovation policy is of an inter-sectoral and multi-dimensional nature and hence its constituency is dispersed and difficult to self-organize. Thus, despite the potential demand, innovation policy may not be established due to difficulties experienced by the constituency to articulate its interests and reach a 'critical mass'.

Overall, the level of development and nature of innovation policy cannot be understood out of context of development and nature of the country's innovation constituency. Thus when assessing different policies, this comparative structural feature should play an important explanatory role. The presence or absence of an innovation constituency is also very important when assessing the possibilities of transferring policy instruments from countries at the innovation frontier to catching up economies and may explain some of the problems in this transfer.

---

[25] European Commission (2007), Commission Staff Working Document Accompanying the Green Paper *The European Research Area: New Perspectives*, Brussels, COM(2007)161.

[26] European Commission (2007), *Global Innovation Scoreboard*, ProInno Trendchart papers. http://trendchart.cordis.lu/scoreboards/scoreboard2006/scoreboard_papers.cfm

CHAPTER 2. SETTING OBJECTIVES IN INNOVATION AND COMPETITIVENESS POLICIES

Setting objectives in innovation and competitiveness policies rests strongly on the underlying rationale for public policy. The rationale implicitly defines the scope of policy and legitimises the innovation policy objectives. However, a consistency between rationale and objectives may not be always present due to the highly political nature of policy formation. In addition, rationales are changing over time in dependence of dominant academic, political and policy discourses.

The traditional arguments for research policy are those of 'market failure' or 'public goods'.[27] The rationale for innovation policy is wider as innovation has strong public and private elements. This explains why there is less agreement regarding the underlying rationale for innovation policy. Thus one often comes across competing rationales in the practice of national governments. For example, innovation and industry departments are usually committed to various strategies to develop a knowledge-based economy, while departments of finance are equally firmly committed to macroeconomic stability and tight control of public finances and debt.[28] Within the NIS perspective, policy rationales are broader and include failures in institutions like universities, patent offices, and in financial system. From this perspective, firms are not optimizers and adaptors but are faced with bounded rationality and significant capability gaps. The recognition of capability failures in the business sector in relation to innovation includes issues like managerial deficits and lack of technological understanding.

In the traditional perspective, framework failures like those in the macroeconomic framework are accepted as legitimate concerns. In the NIS perspective, these extend to a variety of regulatory frameworks like health and safety rules, articulation of consumer demand, cultural and social barriers to innovation. This variety of rationales is usually accompanied by a variety of different scopes of innovation policies and thus with different policy mixes and goals. Within the NIS perspective, innovation is seen as a systemic activity rather than one just confined to an individual firm, which raises the possibility of network or system failures. These are situations where there is a lack of the interaction between the actors in the innovation system due to different types of mismatches. However, the broader scope for innovation policy – as justified by new types of rationales – increases also the scope for policy failures.

2.1 BASIC CONDITIONS FOR THE SUCCESS OF INNOVATION AND COMPETITIVENESS POLICIES.

The experiences of many developing and emerging market economies in the world (including the catching up economies in the UNECE region) demonstrate that macroeconomic and business environment factors alone may not be sufficient to promote innovation,

[27] Research or science policy is 'concerned with the development of science and the training of scientists', while innovation policy takes into account the complexities of the innovation process, and hence aims to facilitate the interactions between firms of all sizes and public and private research institutes. See Mark Dodgson and John Bessant (1996), *Effective Innovation Policy: A New Approach*, London/Boston, MA: International Thomson Business Press, pp. 4-5.

[28] OECD (2005), *Governance of Innovation Systems, Volume 1: Synthesis Report*, Paris: OECD.

competitiveness and growth. An emerging alternative view is that growth constraints are never general and generic (proximate causes) but most often specific (ultimate causes).[29] The World Economic Forum Global Competitiveness Report and other similar rankings that seek to identify micro obstacles to growth focus on the generic answers to broad classes of questions. However, the elimination of these deficiencies by itself may not be sufficient to promote growth as demonstrated by countries that have significantly improved the quality of their business environment and framework conditions and yet innovation-based growth did not follow (for example, Latin America).

An issue that is still open for discussion is whether the business environment is a more important determinant of innovation than some specific innovation policy mechanisms. A current mainstream wisdom is that the business environment is essential to innovative behaviour through a stable macroeconomic framework, tightness of incentives and remedy of market failures only in areas where the incidence of market failures seems to be widely accepted (science and education).

At the same time, the increasing importance of the NIS perspective sometimes tends to undermine the relevance of the distinctions between 'broad' and 'narrow' policy mixes or between framework and specific policy measures. For example, the highly focused horizontal policies like the EU Technology Platforms tend to undermine the traditional distinction between vertical, or sector-specific, industrial policies and horizontal, or generic, innovation policies.

Also, the evolution of innovation policy shows that traditional distinctions are not very useful any more. It has been suggested that there are three generations of innovation policy.[30] The traditional innovation policy was primarily oriented towards R&D, that is, the supply side of innovation. A current mainstream is the second generation of innovation policy which is oriented towards systems and clusters. The emerging at present third generation of innovation policy assumes that there is a potential for innovation which is embedded in other sectors or policy domains. This potential can be realized by ensuring cross-sectoral optimization of the components of various sectors' innovation policy through co-ordination and integration. This cross-sectoral optimization could be horizontal, vertical and temporal. According to an OECD study, 'horizontal coherence ensures that individual, or sectoral, policies, build on each other and minimise inconsistencies in the case of (seemingly) conflicting goals. Vertical coherence ensures that public outputs are consistent with the original intentions of policy makers. Temporal coherence ensures that today's policies continue to be effective in the future by limiting potential incoherence and providing guidance for change'.[31] As an illustration, many of these issues are present in the analysis of the challenges that the Swedish national innovation system is facing as well as in the experiences of other UNECE countries (see Box C.2.1)

[29] Ricardo Hausmann and Dani Rodrik (2003), "Economic Development as Self-Discovery", *Journal of Development Economics*, Vol. 72, No.2, pp. 603-633.

[30] EU (2002), "Innovation Tomorrow. Innovation Policy and the Regulatory Framework: Making Innovation an Integral Part of the Broader Structural Agenda", Available at http://cordis.europa.eu/innovation-policy/studies/gen_study7.htm

[31] OECD (2005), *Governance of Innovation Systems, Volume 1: Synthesis Report*, Paris: OECD, p. 23.

Box C.2.1 Country experiences: Setting the conditions

Assessment of the challenges to the Swedish national innovation system[32]

According to a benchmarking analysis, the long-term competitiveness of the Swedish national innovation system was assessed to be relatively weak during the period 1970–2003. In terms of relatively radical renewal, through start-ups and high growth in such firms, the Swedish national innovation system has been considerably less competitive than in terms of large industrial groups with advanced technology. However, the technology and science performance in the Swedish national innovation system was at the very top of the OECD rankings during 1970–2003, in terms of international patenting and scientific publication.

In relation to the size of its population, Sweden invests more resources than any other country in the OECD on R&D and other activities related to the production, diffusion and use of knowledge. Swedish business sector R&D investments are dominated by large multinational manufacturing groups with high R&D intensity. The strong position of these large multinational industrial groups and the high R&D intensities in Sweden have been strongly stimulated by long-term public-private user-producer relationships, based on technology-intensive public procurement by public monopolies or semi-monopolies. The relatively high stability and technically demanding content of these relationships have promoted a high level of long-term investments in business R&D. By international comparison, Sweden has a relatively low share of university research that is financed by the industry and this share has decreased further in recent years. At the same time, business sector R&D is increasingly focused on development activities closer to the market, while the share of more long-term research activities is decreasing. Thus, the interactions between the scientifically strong university system and the technologically leading industrial groups may be weakening.

The major innovation policy challenges could be grouped in five categories, which, however, are all interrelated and should therefore be addressed within the same general innovation policy framework:
• Start-up, innovation and growth in knowledge-intensive SMEs (How to improve incentives and support structures that would generate increased value added through the establishment of R&D-based SMEs?).
• Improved supply, use and mobility of human resources (How to secure a large enough future supply of highly qualified people to the labour force, together with improved use and mobility of existing human resources?)
• New regime for user-producer public-private partnerships (A relatively high share of R&D in the public sector makes public sector innovation critical to the country's economic competitiveness)
• Increased volume and impact of mission-oriented research (How to increase the volume and impact of the research system on innovation in both the business sector and the public sector?)
• Centres of excellence for research and innovation (How to generate research and innovation environments that simultaneously continue to attract investments by technologically leading firms and improve the rate of innovation-based start-ups and growth in SMEs and large firms).

The national innovation system of the United States

The United States do not have a single policy document or an integrated innovation policy statement which states its innovation policy position. Policy documents are issued by various Executive Branch Departments (for example, the Department of Commerce) as well as non-political organizations (for example, the National Academy of Sciences) but these are not, individually or collectively, a formal statement of U.S. innovation policy. The following seven innovation-related initiatives are thought to jointly describe the components of what could be considered an integrated U.S. innovation policy:
· The Stevenson-Wydler Technology Innovation Act of 1980,
· The Bayh-Dole Act of 1980,
· The R&E Tax Credit of 1981,
· The Small Business Innovation Development Act of 1982,
· The National Cooperative Research Act of 1984,

[32] Vinnova (2004), *The Swedish National Innovation System 1970–2003. A Quantitative International Benchmarking Analysis*. Report written by Göran Marklund, Rolf Nilsson, Patrik Sandgren, Jennie Granat Thorslund, Jonny Ullström, Vinnova analysis va 2004:1.

· The Federal Technology Transfer Act of 1986, and the
· The Omnibus Trade and Competitiveness Act of 1988.

Arguably, these seven enabling U.S. innovation-related initiatives 'were promulgated in large part in the absence of a systematic study of how each complemented the other'.[33] Each of them affects 'a different phase of the innovation process, and some industries, depending on the nature of their R&D and on their life cycles, may benefit more or less from one instrument over another. In practice, however, such systematic coordination rarely takes place in the United States. There are a number of reasons for this, the most obvious being the absence of a single Federal organization that has such a charge. But even if there were such an organization, it would not have sufficient data to undertake an effective coordination effort because such data are not systematically collected. The National Science Foundation (NSF) collects data on science and engineering indicators, but these data quantify the inputs and outputs from innovation rather than the phases of the process'.[34]

Objectives and coordination of innovation policy in Czech Republic

The adoption of the National Innovation Policy (NIP) by the Czech government in July 2005 was an important step forward as this policy specifies 48 concrete targets to improve innovation governance and the national innovation system as a whole. In addition, NIP specifies responsibilities, deadlines, success indicators and evaluation methods. Some of the 48 targets have been fulfilled, some are under way towards their fulfilment, some still wait for a political decision so that progress can be made. One of objectives is to improve the interlinks between support activities in R&D and innovation by a consistent coordination on the governmental level. The R&D Council has been assigned the coordination role in implementing the NIP.[35]

Coordination of innovation policy in Slovakia

Prior to 2007, the innovation-related measures initiated by the Ministries of Economy and Education had not been well co-ordinated, as the two ministries were controlled by alienated coalition parties. A lack of co-operation was reflected in poor linkages between basic and applied research. The new government established the post of Vice Prime Minister for Knowledge Based Economy and also significantly improved coordination among main actors of innovation policies. The Slovak Government Council for Science and Technology was re-structured and its members meet more frequently than before. This change is well visible in a large number of innovation policy documents adopted in last 12 months. However, cooperation between the private and public sectors still lags behind.[36]

Portugal: setting measurable objectives for a shift towards knowledge based economy

One of the strategic objectives of the Portuguese Government is to promote sustained development via a national Technological Plan. The Technological Plan is a tool to convert Portugal into a dynamic economy capable of asserting itself within the global economy. The measures proposed in the Technological Plan are organized according to three Axes of Action:
• Axis 1. Knowledge. Main objective: To qualify the Portuguese for the Knowledge Society. The objective is broken down into 15 quantified targets in the areas of human capital development; infrastructure and access to ICT and the labour market .
• Axis 2. Technology. Main objective: To overcome the scientific and technological gap. This objective is also broken down into 6 quantified targets.
• Axis 3. Innovation. Main objective: To give a new momentum to innovation. The objective is broken down into 5 quantified targets.

[33] Ibid, p. 11.

[34] Ibid.

[35] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Czech Republic, 2007* (draft).

[36] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Slovakia, 2007* (draft).

Israel: coordination towards common objectives[37]

The Office of the Chief Scientist (OCS) at the Ministry of Industry, Trade and Labor (MOIT), which is the main government body in charge of innovation policy in Israel, is responsible for carrying out government policy concerning support for industrial R&D. Firms submit proposals for R&D projects, which are reviewed by the OCS according to a set of criteria that include technological and commercial feasibility, merit and risks, as well as estimation of the extent to which these projects can be expected to generate spillovers. Another government body, the Ministry of Science and Technology (MOST) is responsible for forming a national policy oriented towards science and technology, technological analysis and organization, and for coordinating government research activities to ensure R&D within the Ministry's areas of responsibility.

The Law for the Promotion of Industrial Research and Development of 1984 is the principal mechanism for providing government assistance for high-tech industrial development. The purpose of the Law is to encourage and support industry in order to enhance the development of local science-based industry by utilizing and expanding existing technological and academic infrastructure and improving Israel's balance of trade by increasing the manufacture and export of high-tech products developed within Israel. The Law – which has been revised several times since its adoption – determines the conditions for grants, loans, exempts, discounts and extenuations on the basis of approved programs in order to fulfil the goals mentioned above.

Israel does not pursue an explicit innovation policy, nor are there specific measures for encouraging innovation as a tool for achieving objectives. Innovation is encouraged as a byproduct of R&D encouragement programs. In these programs, innovation is a paramount criterion, but the objective is to encourage R&D that will lead to production, employment and export. It is presumed that without an innovative edge, the chance for market success would be much lower. The Israeli government's policy in this realm has been traditionally "neutral", meaning that the government did not decide which sectors, firms or technologies to support, but rather responded to market demands and signals. Therefore, all technological fields were prioritized equally.

2.2 IDENTIFICATION OF POLICY PRIORITIES AND FORESIGHT

A country's ability to improve the coordination between different policies for achieving long-term objectives becomes paramount to long-term competitiveness and growth. Broadly agreed national priorities in the form of strategic, long-term policies and visions facilitate coordination by providing a consensus and mutual understanding. In uncertain area such as technology development and innovation, priority setting has a relatively long history. Technology planning and forecasting developed in the 1960s and 1970s, and technology foresight in 1980s and 1990s. In order to be successful, priority setting should be embedded in a broader process of innovation and S&T policy formation using inventory of strategic intelligence tools like foresight, benchmarking, monitoring, evaluation, and assessment. In their absence, coordination may take place at lower level activities and consultations.[38]

In order to be effective, this embodiment of priorities has to be present at two levels: at institutional and strategic intelligence levels. At institutional level, policy councils are important in the priority-setting process, but may have weaknesses in terms of the ability to develop comprehensive, horizontal policies for innovation and sustainable growth. At strategic intelligence level, it is essential to establish close links to the priority setting process and use tools like foresight in policy learning.

[37] Daphne Getz and Vered Segal (2007), "Creating a Conducive Environment for Higher Competitiveness and Effective National Innovation Systems. Israel", Report submitted to the UNECE, mimeo.

[38] OECD (2005), *Governance of Innovation Systems, Volume 1: Synthesis Report*, Paris: OECD, p. 10.

Foresight exercises are aimed at enhancing the coordination capability of national and local innovation systems to external challenges. They are basically addressing the issue of *coordination* among science policy bodies and innovation stakeholders. Foresight aims at generating new insights which are not available to individual stakeholders unless they embark on the process of such collective exercises. Knowledge of foresight process that has been accumulated within the EU has now been codified in the form of guides[39] as well as through networking such as the EU foresight monitoring network.[40]

The foresight methodology is not confined to the consideration of approaches for thinking about the future (such as scenario analysis, the Delphi method, etc.) but is far broader and includes coalition building, scoping, organization and management, and implementation.[41] This *action-oriented* component of foresight is the key distinction between foresight and forecasting and it explains why foresight is important as an innovation policy tool. A foresight exercise is a participatory process with the objective to: a) achieve *a better common understanding* of the desirable and feasible visions of the future, and b) bring *together and network* different stakeholders involved in their implementation. These elements are mutually related: better common understanding is needed for networking but also better networking is a precondition for generating common understanding. Addressing this chicken-and-egg problem is one of the core difficulties for foresight practitioners.

Box C.2.2 Country experiences: Foresight

The foresight programme of the United Kingdom [42]

The United Kingdom is one of countries with the long experience in foresight activities. In 1993, a White Paper, *Realising our Potential - A Strategy for Science, Engineering and Technology* indicated that the Government would launch a Technology Foresight Programme, led by the Chief Scientific Advisor. The aim would be to ensure closer interaction between scientists, industry and government through a programme, which sought to identify future opportunities and threats for science engineering and technology.

The first round of Foresight was launched in 1994 and brought together experts from industry, government and academia into 15 sector-facing Panels to explore opportunities in different sectors of the economy. During the main analysis phase, these panels considered emerging market and technological opportunities over a 20-year timescale, consequent priorities for research, and other actions needed to exploit them.

Following widespread consultation involving some 10,000 people, the panels published their first findings in 1995, identifying more than 360 recommendations for action. The reports aimed at identifying the likely social, economic and market trends in each sector over the next 10-20 years and the developments in science, engineering, technology and infrastructure required to best address future needs.

[39] For an example of an online foresight guide see: http://forlearn.jrc.es/guide/0_home/about.htm.

[40] See http://www.efmn.info/.

[41] For a discussion see Michael Keenan (2004), "Review of Foresight Activities in Czech Republic, Hungary, and Bulgaria, Report prepared for the ForeTech Conference", Sofia, 27 May 2004, Available at: http://foretech.online.bg/docs/Tabulated%20Comparison%20of%20Foresight_MK_May27-2004.pdf.

[42] See http://www.foresight.gov.uk/

The second round of Foresight began in April 1999. Work was taken forward through a combination of 3 thematic and 10 sector panels, each looking at the future for a particular area of the economy. This round moved beyond the technology focus of the first round to examine the opportunities that arose from the interaction of innovations in science and technology with wider social and market trends. Each Foresight panel looked at the future for a particular area, identifying the challenges and opportunities that the country was likely face over the next 10-20 years and beyond. These panels and their task forces, published reports in December 2000.

In 2000, the Foresight Programme was re-examined with a view to ensuring that it addresses the challenges of the future. As a result, the programme moved away from a structure of standing panels towards a new rolling programme of projects established in April 2002. The starting point for a project is either a key issue where science holds the promise of solutions or an area of cutting edge science where the potential applications have yet to be considered. Projects run for 18 months to two years, and result in a series of actions, the implementation of which are the responsibility of key stakeholders. Each project has a sponsor Minister and involves networks of experts and stakeholders.

In its Science and Innovation Investment Framework 2004-2014, the Government committed to establishing a Centre of Excellence in Horizon Scanning, to be based in the Foresight directorate of the Office of Science and Innovation. The Centre seeks to inform departmental and cross-departmental decision making, support horizon scanning carried out by others, spot the implications of emerging science and technology and enable others to act on them. It achieves this through regular cross-government scans, project work with stakeholders and support to spread good practice. The Centre's output feeds directly into cross-government priority-setting and strategy formation.

Canada's Technology Roadmaps: the Canadian version of foresight[43]

The Technology Roadmap (TRM) concept – as applied in Canada – is a consultative process designed to help the industry, its supply-chain, academic and research groups, and government agencies come together to jointly identify and prioritize the technologies needed to support strategic R&D, marketing and in-vestment decisions. It deals with technologies of critical importance to an industry in the next five to ten years. In developing a TRM, companies within a sector come together in a joint commitment to identify the critical technologies as well as the skills required to properly utilize the technologies of the future. The TRM is a means to achieve a joint decision on future research and development, future skills development, and to establish a commitment to work together to address these challenges.

The TRM process in Canada is led by industry and facilitated by the government. A synthesis of six Technology Roadmaps undertaken by Industry Canada (the Government of Canada department dealing with innovation and competitiveness policies)[44] concluded that overall, TRMs were viewed as worthwhile exercises. Evaluation findings suggested that industry members recognized the potential value of Technology Roadmaps, and believed that Industry Canada provided an important contribution to the initiatives. These factors contributed to participants' staying committed to the TRM process until completion. A number of factors were identified as influencing the progress of a TRM. For example, it has been found that having a facilitator is essential to a TRM and that the TRM collaborative approach adds significant value. Also, assessing an industry's readiness for a TRM is important, particularly the importance of industry-wide issues, an industry's ability to converge on a set of critical technologies, and the speed of an industry's technology development.

Step by step: the Danish Pilot Foresight [45]

The Danish Government carried out a Technological Foresight pilot programme from 2001 to 2004. The aim was to identify – through eight foresight exercises – issues of strategic policy importance within the

[43] Marina Ranga and Henry Etzkowitz (2007), "Final Synthesis Report: Identification and Analysis of Policies to Promote Investment in Research in Non-EU Countries", mimeo.

[44] See http://strategis.ic.gc.ca/epic/site/trm-crt.nsf/en/h_rm00049e.html.

[45] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Denmark, 2006*.

areas of science, technology, education, regulation and innovation. Foresight exercises have been concluded in areas such as pervasive computing, bio- and healthcare technology, future green technologies, hygiene, nanotechnology, the ageing society and ICT in the agriculture and food production sector. The last phase of the foresight pilot programme is the link to "High Technology Fund" for the development of generic technologies of future importance such as ITC, biotechnology and nanotechnology. The link operates through a dialogue within the framework of foresight exercises in order to identify specific areas of strategic importance to Denmark that could be supported by the fund.

Hungarian Technology Foresight: a pioneer in central and eastern Europe[46]

Hungary was the first country in Central and Eastern Europe to undertake a Foresight programme. TEP, the first Hungarian Technology Foresight Programme, was based on the first UK Technology Foresight Programme, but also drawing on German experience. It was adapted to the Hungarian context, in particular, by incorporating scenarios at the macro level, as well as by putting more emphasis on socio-economic issues – given the transition process and the level of development of Hungary – than on S&T ones, per se. TEP was considered a success from a methodological point of. Practitioners and policy-makers in other catching up economies are still interested in this experience and the lessons learnt. However, TEP (its 8 final reports were published in 2001) did not have an immediate policy impact; its results and recommendations were implemented with delay, in several cases, indirectly. A new round of foresight is not yet on the agenda.[47]

The Technology Foresight Programme in Slovakia was initiated after a Regional Conference on Technology Foresight held in 2001. The Government took the decision to launch the Technology Foresight Programme as one of ten national R&D programmes starting in 2002. The Technology Foresight activities acquired wide recognition in Slovakia and are currently used within the framework of the development of the regional innovation strategies[48]. Foresight exercises have been initiated in several other catching up economies (Bulgaria, the Czech Republic, Hungary, Poland, Romania, among others) as a way to enhance their endogenous capabilities for defining priorities and consensus on long-term objectives.

Russia has recently embarked on an ambitious foresight exercise. Three ministries are working simultaneously on the development of Foresight procedures: the Ministry of Education and Science, the Ministry of Industry and Power Engineering, and the Ministry of Information Technology and Communications. Each of the Ministries is developing its own approach, without consultation or coordination with the other Ministries and agencies. At the present time, despite the popularity of Foresight among policy makers, only a small circle of experts is aware of the Foresight methodology, and understand how at national and other levels the results of such work may be used. The problem also stems from the lack of interaction among various expert groups. However, the forecast exercise represents one of the first attempts made by the government to involve business circles in the decision-making process concerning future technological development of the country.

Foresight should be instrumental in shifting national innovation systems in the UNECE catching up economies from their dominant focus on knowledge generation towards diffusion, absorptive capabilities and improving their relevance to local users (demand component). This does not mean that science foresight is not necessary in the catching up

[46] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Hungary, 2006*.

[47] Attila Havas (2003) "Evolving Foresight in a Small Transition Economy: The Design, Use and Relevance of Foresight Methods in Hungary", *Journal of Forecasting*, Vol. 22, No. 2-3, pp. 179-201; Attila Havas (2003), "Identifying Challenges and Developing Visions: Technology Foresight in Hungary", In: Ch-S. Chung and J. Park (eds.), *National Visions and Strategies*, Seoul: KDI School of Public Policy and Management and The World Bank, pp. 231-268.

[48] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Slovakia, 2007* (draft).

economies but only that foresight should also address more downstream type activities like innovation and supporting activities as well as knowledge-based services.

Box L.2.1 Lessons learned: Foresight[49]

Foresight exercises in different countries largely reflect the nature of their sectoral or national systems of innovation. In general, they do not have power to transform radically the relationships in the respective systems of innovation. However, they can facilitate change within the given frameworks and relationships among stakeholders. In short, there emerges a link between the type of foresight programme and the scope of innovation policy. For example, the science character of the first Czech foresight has further reinforced exclusively the R&D orientation of the Czech innovation policy. E-Government foresight in Bulgaria has facilitated already established policy agenda. Also, the Romanian foresight has been instrumental to the already present policy agenda.

Foresight offers opportunities to generate structural breaks in terms of the critical mass of awareness of foresight related issues. For example, Hungarian foresight illustrates that such programme can operate as 'big bang' mechanism in terms of generating a critical mass of understanding within businesses and the R&D constituency about the need to develop explicit innovation policy as a way to ensure the basis for long-term competitiveness and growth. The critical break in terms of awareness cannot be entirely generated by foresight itself but can be significantly pushed by it. Successful foresight rests on a combination of factors of which the good and professional work of the project team is only one of the necessary ingredients.

Foresight exercises are inherently difficult to assess from a policy perspective. This is mainly due to the fact that most often they are unlikely to produce discernible outcomes within the timeframe of the project. The outcomes may be visible in a few years but seldom immediately. As the Hungarian example suggests, the actual process between understanding and realization of that understanding is a complex political process where leads and lags are imminent. It must be accepted that there will be sometimes long time lags between proposals/recommendations and their implementation which will reflect the political dynamics of the individual country. So, the effects of awareness raising may come several years later.

The underdevelopment of innovation policy is the most serious hindrance to good foresight. Innovation policies that abound in cooperative programmes and which address different dimensions of innovation capacity (R&D, diffusion, demand, and absorptive capacities) are in much greater demand for foresight. This is the reinforcing effect of foresight whereby already developed innovation policies generate stronger demand for more coordination and for understanding of long-term challenges while undeveloped innovation policies do not have such demand is an issue that is difficult to address.

2.3 COMPREHENSIVENESS, RELEVANCE AND EFFECTIVENESS OF THE POLICY MIX.

A policy mix that addresses a range of policy objectives is usually associated with a certain type of failures. Hence, the policy rationale of innovation policy generally determines the scope of the policy mix and whether the dominant concern will be only the 'broad' or also the 'narrow' policy mix. The 'broad' policy mix addresses the space from macro and business environment policies to the specific innovation policy instruments. The 'narrow' policy mix covers the policy instruments within innovation policy proper, no matter how broadly or

[49] Slavo Radosevic (2004), "Foresight as S&T and Innovation Policy Tool: Policy Lessons from Bulgarian, Czech and Hungarian Foresight Exercises", Paper prepared within the FORETECH project, mimeo (available at http://foretech.online.bg/docs/AnalyticalComparison_PolicyImplications_SR_May2004.pdf).

narrowly it is defined. However, these categories are never found clear-cut in practice due to difficulties in ascribing which policy instruments affect the innovation process and how they do this.

The problem of attribution is less pronounced in the case of explicit innovation policy measures, that is, those measures that explicitly declare as their objective the enhancement of the innovation process. In the case of implicit innovation policy measures (those measures that affect the innovation process indirectly), this is less clear. As these measures are not designed primarily with innovation objectives in mind but do have spontaneous and sometimes significant effects, the latter may be difficult to evaluate. For example, the effects of different IPR regimes or those of patenting rules are not easy to evaluate as there is a significant trade-off between the effects on innovation and the opposite effect on diffusion. Also, a tight competitive environment is not necessarily advantageous for innovation as the relationship between innovation and competition is non-linear.[50]

The recent evolution of innovation policy has led towards its interpretation and understanding as systemic policy whose aim is to ensure the comprehensiveness and coherence of the innovation promotion efforts. This indicates that there is an ongoing shift from individual to systems instruments.[51] In other words, the shift is from single agent/single measure instruments (such as a subsidy to a company to carry out an internal product development project) to network measures where a combination of different measures (such as grants to partnerships of companies or research organizations, funding for clusters or network managers, actions to remove system failures such as access to finance, etc.) are brought together in a policy framework.[52]

The importance of systemic instruments arises from the increasing importance of new functions in managing the contemporary innovation process, such as: management of interfaces; (de)construction and organizing (innovation) systems; providing a platform for learning and experimenting; providing an infrastructure for strategic intelligence; stimulating demand articulation, strategy and vision development.[53] As the already functioning instruments cover a small part of these systemic functions, one can expect significant future changes in the policy mixes and policy objectives and also a shift towards a wider use of systemic instruments (See Box C.2.3).

Within the group of the catching up UNECE economies, in the early transition years (the period of 'transformational recession'), the macroeconomic imbalances and institutional instability prevented substantial and comprehensive innovation policy activities. During this period, the dominant political philosophy was liberalization and privatization. The emergence of explicit innovation policy in these countries has taken place in the period of recovery when policy makers started to realize that the structural change in their economies is unlikely to

[50] Philippe Aghion, Nick Bloom, Richard Blundell, Rachel Griffith and Peter Howitt (2005), "Competition and Innovation: An Inverted-U Relationship", *Quarterly Journal of Economics*, Vol. 120, No. 2, pp. 701-728.

[51] Ruud Smits and Stefan Kuhlmann (2004), "The rise of systemic instruments in innovation policy", *International Journal of Foresight and Innovation Policy*, Vol. 1, Nos. 1-2.

[52] Alasdair Reid (2007), "Science & Innovation in the 21st Century: lessons for European core and peripheral economies", Paper presented at the Conference: 'Why Invest in Science in South-Eastern Europe?', Ljubljana, 28 September 2006 (forthcoming as chapter in UNESCO Proceedings volume).

[53] Boekholt, P. et al (2001), "An International Review of Methods to Measure Relative Effectiveness of Technology Policy Instruments", Final Report, July 2001, Technopolis Ltd.

come about only through the liberalization of markets. Thus experience showed that FDI by itself does not guarantee transformation towards knowledge-based economy and catching up. This has opened room for new, more pragmatic policy thinking that had been widely absent during the early transition years. The best examples are the Czech Republic and Estonia, which during the early transition years were perceived as paragons of the free market economy; by the end of the 1990s, both countries made first but visible steps towards active promotion of structural change through innovation policy.

However, the shift towards innovation policy can be explained not only by internal dynamics of transformation process but also by two additional factors. First, innovation policy is a 'horizontal policy' and thus politically acceptable to parties of different ideological origin. Unlike proscribed 'vertical' industrial policies of 'picking the winners' type, innovation policy does not carry such burden. In addition, in budgetary terms it is relatively 'light' policy and thus conforms to a world of low budget deficits. However, this is changing: EU supported policy actions are in relative terms quite 'financially heavy' and Russian innovation policy instruments are also financially quite large. Second, EU accession has pushed the NMSs towards a new regulatory role of the state, which is not only a 'watchman' but also supports innovation activities based on market failure and other types of rationale.

Box C.2.3 Country experiences: The changing innovation policy mix

A relatively stable broad mix of policy instruments in Germany[54]

The policy mix of the German federal government follows three main policy lines:
• Improving the framework conditions for innovation, notably by simplifying the tax system and reducing the tax burden for firms, and by simplifying the bureaucratic procedures that may inhibit innovation and the start-up of new enterprises.
• Improving the education and science system in order to tackle shortages in the supply of qualified labour, to improve companies' access to high qualified personnel, including vocational and on-the-job training, and to provide a public research base as a partner in innovation projects.
• Promoting innovation activities in firms by means of financial aid. Subsidies are delivered through four channels: R&D grants for research in high-tech areas; R&D grants for co-operative research by SMEs; financial support for innovation projects in technology oriented SMEs (loans or venture capital); technology consulting services and provision the related infrastructure for innovative enterprises.

Consequently, there is a broad mix of innovation policy instruments, ranging from fiscal policy, competition policy and the simplification of administrative procedures to education and science policy, various financial (loans, guarantees, subsidies, equity) and awareness measures targeted at firms. At the same time, tax incentives are not applied in Germany as a way to stimulate corporate R&D investments. Nevertheless, improving the fiscal framework for innovation is a major priority of the federal government, and recently changes have been implemented to improve fiscal treatment of venture capital.

There are several reasons for the relative stability of Germany's innovation policy:
- Stability in the instruments is viewed as a quality element of innovation policy in terms of supporting confidence among innovation actors, especially as regards the long-term stakeholders' decisions.
- Large economies are more likely to use a variety of policy instruments since narrow technological specialization is less likely. The different types of market failures call for a broader policy mix.
- The main orientation of innovation policy is undisputed by all major political parties. Therefore, government changes have relatively little direct impacts on the design of innovation policy.
- Implementing changes in the framework for innovation needs time. Frequent changes in measures are inefficient as the time for achieving the desired effects may be to small.

[54] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Germany, 2006*.

The Spanish experience [55]

A new Spanish industrial policy promotes innovation in four major forms, corresponding to four paradigms on the innovation process. First, the Directorate General for SMEs promotes policies for innovation addressing SMEs, in particular, through the so-called Technology Centres. Second, the strategy of support and consolidation of major R&D programmes focussing on big companies has been also implemented. One such example is the new aeronautics policy. Another example is the Centre for Industrial Technological Development (CDTI) which finances projects of business R&D, promotion and management of the participation in international programmes of technological cooperation, support for the transfer of technology and the creation and consolidation of technology-based companies. Third, innovation is actively encouraged through taxation. Fourth, innovation and diffusion of innovation is promoted through Programmes for Promoting Technological Innovation (PROFIT). Their main aim is raising the technological and research capacity of businesses, promoting the creation of innovative business fabric and contributing to the creation of an environment favourable to investment in R&D, attempting to improve the interaction between the public research sector and the business sector.

A changing policy mix in the Netherlands

Policy measures aimed at improving collaboration form the core of the policy mix supporting the innovation system in the Netherlands. The wide set of instruments addresses the needs of different actors and technology fields. New measures aimed at stimulating public-private cooperation have also been introduced. The objective is to achieve greater flexibility and customised solutions to meet the needs of businesses. The accessibility of the instruments is improved by reducing the number of access points and by means of a substantial reduction in the preparation costs and administrative burden.

The new approach clusters the restructured instruments in two different "packages":
• A "basic package", primarily aimed at SMEs, providing information and advice on access to the knowledge infrastructure, financial support in the form of credits, loans and guarantee schemes, etc.
• A "programme-based package" aimed at specific key areas of strategic importance for the Dutch economy. In collaboration with the ministry of Economic Affairs, actors within a specific key area (industry, universities, etc.) define the organization and objectives of an innovation programme, allocate the financial resources, and formulate projects supporting the programme objectives.

The reform of the policy mix is accompanied by a change in the role and structure of the organizations involved in policy delivery of industry-oriented research and innovation, resulting in the establishment of a 'one-stop-shop' for entrepreneurs with promising business ideas in need of support. The entities involved at present will evolve into a (virtual) front office addressing needs of industry and their role in policy formulation will also change in time.

The Estonian Policy Mix[56]

The current innovation policy mix adopted in Estonia is focused on three categories of measures:
• support for innovation activities;
• support for innovation awareness and capability raising;
• support for infrastructure development.

The ongoing programmes are dealing mainly with the first type of measures. These are R&D financing programme, SPINNO programme for starting high-tech companies and enhancing entrepreneurial mindset in universities and (Technology) Competence Centres programme to build a bridge between enterprise and research sector for long-term cooperation. The objective of the Business Incubation Programme is to support the provision of incubation services in Estonian business incubators.

Recent efforts are concentrated on programmes related to innovation awareness raising and R&D infrastructure development. The objective of the programme 'Good Estonian Idea' is to increase the knowledge on innovation as a key factor of raising peoples' welfare and the country's competitiveness,

[55] As described by Joan Trullén, Secretary General for Industry Ministry of Industry, Tourism and Trade: Joan Trullén (2006), "The New Spanish Industrial Policy: Innovation, External Economies and Productivity", 20 September 2006, mimeo.

[56] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Estonia, 2006*

and to raise the capabilities and skills for successful implementation of innovation projects in the research and enterprise sectors. Another example is the R&D institutions infrastructure development programme whose main objectives are: to stimulate the strategic planning of R&D activities; to improve the efficiency of the R&D activities via better linking between actors and institutions; to increase the human resources involved in R&D activities and to ensure its sustainable development.

The Greek innovation policy mix[57]

Greek innovation policy is a derivative of either research policy or of private investment policy and the actual mix can be viewed as the sum f the two. From the 'research' point of view, innovation materializes through the commercialization of research results or the knowledge accumulated in research teams. From the 'private investment' point of view, innovation is associated with decisions to enter new markets with new products, or to improve production processes in order to enhance quality and reduce production cost. The two approaches work in parallel, with no particular coordination from the top. The overall policy mix is formulated almost exclusively in the Operational Programme for Competitiveness, which has gone through an ex-ante evaluation carried out by an independent evaluator.

Romania: a need for strategic change in the policy mix[58]

Romania like other post-socialist countries has a large concentration of R&D capability in the research institute sector which is largely composed of sector-based organizations seeking survival strategies in a market environment characterised by the absence of conventional sources of funds and limited demand for their outputs. The R&D capacity in the university and industry sectors is underdeveloped. Greater efforts are needed therefore to stimulate research activities within universities; to enhance the quantity and quality of scientific and technological education and training activities; and to attract young people to enter into S&T and research careers.

Stimulating industrial innovation in Romania constitutes a challenge. The attempts to stimulate the innovative capacity of industry has taken three main forms:
• The conversion of existing non-innovative capacity into an innovative one;
• The renewal of innovative capacity via the formation of new, innovative firms;
• The attraction of external sources of R&D and innovation capacity.
All of these require different policy approaches and mixes to ensure that the policy measures chosen tackle the most pressing problems. Romanian innovation policy therefore should consider a three-pronged approach when constructing policy mixes designed to stimulate the innovative capacity of industry.

For the EU, the danger that the NMSs will develop into low cost production site but also into marginal area in terms of knowledge based activities is real. This would be quite heavy burden and would lead to serious cohesion issues for the region that tries to become the most knowledge intensive economy in the world. Hence, there are overlapping interests between EU and the NMSs in building up research, technology and development capacities (RTD).

During the negotiation process, the NMSs were advised to produce industrial strategies as an insurance that they can withstand competitive pressures, which come through adoption of Single Market regime. In several NMSs, the push that came from the EU towards innovation policy played a role of tilt, which shifted the balance in favor of innovation policy. The accession has strongly influenced the shape of innovation policies, the speed of implementation and scale of its instruments. In the EECCA region, recovery and growth have

[57] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Greece, 2006.*

[58] EC (2006), "Policy Mix Peer Reviews Country Report: Romania Second Cycle of the Open Method of Coordination for the Implementation of the 3% Action Plan", Report prepared for the CREST Policy Mix Working Group by Ken Guy, Wise Guys Ltd., in conjunction with IPTS March 2006

led to increasing concerns whether such growth is sustainable in a long term and whether innovation promotion could be a solution to avoid boom and bust cycle of growth.

However, it is uncertain whether similarity and convergence in R&D and innovation policies across countries of different level of income and institutional development is necessarily the best way forward. A World Bank study on public support to commercial innovation concludes that the heterogeneity of countries in terms of the development of their NIS imply the need for a differentiated approach. 'Whilst some countries have already developed most elements of their NIS and would therefore certainly benefit from public financial support from commercial innovation, some countries are less ready for these types of intervention and might be better off concentrating their efforts on reforms that improve the institutional requisites for these types of intervention'.[59]

In essence, the dilemma is about appropriate policy mix: whether to allocate public support for specific innovation interventions or in the requisite institutions that support innovation (framework conditions). Probably, there is not general answer to this question or rule of thumb which be used as a criteria to follow one or the other approach (see Box L.2.2). Any answer should be country and context specific and should be based on systematic evaluation.

Box L.2.2 Lessons learned: Is innovation policy necessary?

The process of economic transformation in the catching up economies during the 1990s shows that innovation does take place even with ineffective innovation policy. If so, is innovation policy indispensable? Indeed, the possible impact of innovation policy should not be overestimated. However, one should bear in mind that the sources of growth in the catching up economies have been changing. During most of the first ten years of transition, growth has been unrelated to domestic technology accumulation. Large-scale reallocations from unproductive parts of industry to services, from less to more efficient firms have ensured growth for some period. However, there are signs that the sources of productivity growth, which have been mainly in realm of 'reallocations', now have come to an end and that these countries will have to grow based on technology accumulation.

The catching up UNECE economies may still grow for some time unrelated to domestic R&D and without innovation policy based on the access to EU funds (the NMSs) or natural resources (some EECCAs). However, they may soon reach limits to this type of growth and face structural barrier or threshold level, which will require new national system of innovation and policies to be overcome.

Innovation policy is not a quick fix which can be employed within electoral cycles. In order to be successful it requires a long-term view and broad consensus of various stakeholders. As demonstrated by the experiences of both the developed and the catching up economies, this policy is easier to establish in periods of growth rather than depression. However, this also reduces pressure for its development and its effectiveness. A danger of deadweight losses and unproductive rents is real.

Targeting agents or linkages?

Notably, for the time being, the currently prevailing innovation policy mix is still largely oriented towards supporting R&D in individual organizations. Moreover, the use of systemic instruments in the catching up economies is not without problem. A use of systemic instruments assumes that that there are no agents' failures, that is, there is an implicit

[59] Itzhak Goldberg et al. (2006), "Public Financial Support for Commercial Innovation", ECSPF, Chief Economist's Regional Working Paper series, Vol. 1, No. 1, Europe and Central Asia, p.52.

assumption that the main problems are linkages between agents rather then weakness of local firms, universities or RTD institutes.[60]

The problem of linkages for innovation has been recognised on both the supply and the demand side.[61] Moreover, the EU-US productivity gap is partly attributable to the superior connectedness in the US NIS compared to that of the EU. According to some authors, the weaknesses of the 'system-of-innovation' oriented EU innovation policy approach in relation to that in the US is that the nature of linkages is considered as the most important factor, neglecting the issue of the strength of actors, be they weak 'binding agents'[62] or weak European corporations.[63] Furthermore, the EU Structural Funds policy is based on the assumption that building bridging or intermediary organizations like innovation centres, S&T parks as well as the commercialization of R&D from public research and technology organizations (RTO) are key instruments to foster innovation based growth in the EU regions.[64]

An alternative view is to recognise that there is a close relationship between organizational capabilities and linkages in national systems of innovation, especially in the catching up economies. An excessive focus on linkages and on commercialization – without understanding that weaknesses at firm level themselves are tantamount to a weakness in linkages – may be misplaced. Good policy should take into account this crucial balance between the focus on agents (firms and their organizational capabilities) and on linkages with other actors in the system of innovation (universities, RTO, etc.). Focusing exclusively on the enhancing of linkages and ignoring agents or key nodes of networks may reduce the effectiveness of policies.

The currently dominant approach to linkages is based on two main underlying assumptions. First, it is assumed that there are universities and RTOs, which have marketable inventions and an ample supply of entrepreneurs looking for such marketable inventions. Second, these entrepreneurs are most often associated with new ventures and not with established firms willing to undertake new R&D and innovation projects. Both of these assumptions seem

---

[60] For example, an OECD study on Russia concludes: 'Knowledge creation in the business sector is also hampered by limited interaction with the public R&D sector. This means that the national innovation system – broadly defined as the "network of institutions and private sectors whose activities and actions initiate, import, modify and diffuse new technologies" – is not performing well. Most research personnel in the Russian Academy of Sciences (RAS) system and in universities have little incentive to worry about the commercial application of their work. This lack of engagement between the science sector and business contributes to relatively poor performance with respect to innovation outputs'. Christian Gianella and William Tompson (2007), "Stimulating Innovation in Russia: The Role of Institutions and Policies", *OECD Economics Department Working Papers*, No. 539, Paris: OECD, pp.12-13.

[61] CEC (2004), *The EU Economy: 2004 Review*, European Commission, COM (2004)273; Aho Group Report (2006), *Creating an Innovative Europe* (20 January 2006), (available at http://ec.europa.eu/invest-in-research/action/2006_ahogroup_en.htm).

[62] Albert O. Hirschman (1958), *Strategy of Economic Development*, New Haven: Yale University Press.

[63] Giovanni Dosi, Patrick Llerena and Mauro Sylos Labini (2005), "Evaluating and Comparing the innovation performance of the United States and the European Union", Expert report prepared for the Trend Chart Policy Workshop 2005, June 29, 2005.

[64] An analysis of the current disbursement of funds for Poland suggests that building intermediary organizations (that is, linkages) is the dominant funding approach during the 2004-2006 period. Jacek Walendowski (2006), "Strategic Evaluation on Innovation and the Knowledge Based Economy in Relation to Structural and Cohesion Funds for the Programming Period 2007-2013: Poland", Technopolis Belgium.

questionable in the context of the catching up economies as the availability of suitable projects waiting to be exploited by local entrepreneurs cannot be taken for granted and, moreover, as documented by a number of innovation surveys in these countries, it is the existing large firms rather than small firms that seem to be more active innovators.

There is an essential interdependence between linkages and the capacity of the related 'actors' (economic agents). Whether new linkages will emerge depends on the strength of actors but also on the strength of regional, trans-regional and international linkages. It is plausible that in highly developed systems of innovation, an exclusive focus on linkages may be appropriate as the core problems may be those most closely related to the coordination issues. However, an excessive focus on linkages, in a context characterised by the weakness of actors (be they domestic firms or local universities) may be counterproductive. This is not to deny the importance of linkages but rather to stress that these cannot be understood without appreciating the problems facing the relevant economic actors.

Both linkages and organizational capabilities of firms and other organizations are important for innovation. In fact, with the increasing fragmentation of global value chains, the distinction between them becomes blurred through *system coordination* capabilities. Globalization has further reinforced the importance of organizational capabilities though these are now *systemic capabilities*, that is, the capacity to operate across value chains and to coordinate either the whole or some segments of it.

Box C.2.4 Country experiences: The importance of targeting linkages

Difficulties in the science-industry links in Czech Republic[65]

The example of the Czech Republic highlights some of the difficulties existing in a number of post-communist countries. It is recognized that the links between businesses and universities remain limited in the Czech Republic due to the eroded status of higher education institutions within the national innovation system. According to the previously imposed Soviet-type model, R&D activities were concentrated in the Academy of Sciences and not in universities, which have yet to re-establish their research status. In addition, a significant part of the institute-based applied industrial research segment was destroyed in the first half of 1990s as a result of the difficulties in adjusting to the new market conditions and the drastically reduced public funding. Thus overall the Academy of Sciences still has a dominant position in basic research, while university research activities are developing rather slowly with negligible share of business sector in university R&D financing. The less intensive links between universities and businesses may also be partly attributed to the legal difficulties related to the linkages between public and private partners. There are some examples in technology transfer centres of the more pro-active Czech universities which, however, cannot fully offset the existing structural problems. All these difficulties underscore the importance of targeting linkages in the context of the innovation policy mix.

By way of example of how the weaknesses of agents may underline the efficiency of policies, consider also the Swedish example of intermediation between academic research and its industrial realization. A recent analysis has come up with the conclusion that Swedish universities "have proven incapable of fulfilling the intended function of intermediary between academic research and industrial exploitation

[65] Based on Anna Kaderabkova (2006), "Supporting Industry-Science Relations in European Regions: Good Practices – The Case of the Czech Republic", Centre for Economic Studies, Prague

and do not live up the needs of industry in terms of contract R&D".[66] In its stead, an institute sector that by international standards is weak, fragmented and small has had to fulfil this role.

France: the importance of international university-industry linkages for highly innovative firms

In designing the policy instruments targeting linkages, policy makers need also to take into account the fact that science-industry linkages are no longer nationally bounded; on the contrary, these linkages are increasingly internationalised. An example based on the assessment of linkages in France provides evidence to this effect. A study based on the Community Innovation Survey, provides information on the innovation process and the external links of French universities. [67] The study shows that:

• Most benefits from contacts with universities and public research organizations arise from formal collaboration. There is little evidence of direct spillovers from universities as confirmed by the low percentage of firms having declared using information from universities. It appears that the magnitudes of these externalities are much smaller than other types of spillovers, such as spillovers from customers and suppliers.

• Highly innovative firms engage in formal cooperation with European universities while cooperation with domestic universities has limited such effect. Indeed, highly innovative firms are at the frontier of the domestic academic knowledge in their industry and have state-of-the-art research department. Therefore, they only marginally benefit from aggregate (or industry-wide) spillovers from domestic universities. They need new forms of academic knowledge that they acquire through formal cooperation with foreign universities.

• Firms that attempt to catch-up to the most innovative companies benefit the most from state-of-the-art knowledge generated by academic scientists.

The effectiveness of policies

One of the key ingredients in the design of the policy mix is the understanding of the effectiveness of the larger portfolio of policies targeted towards enhancing the country's innovative capabilities and the tradeoffs that are embedded in any portfolio (see also Box C.2.5).[68] For example, what is the balance between policies to enhance R&D and those to support the skill base of the economy? Or, how these two policies could complement each other? Are indirect policies like R&D tax subsidies more appropriate when compared to direct subsidies? What should be the balance between a focus on world class relevance in R&D and diffusion-oriented innovation policy instruments? What should be balance between support for the science base and support for business innovation?

Policy portfolios and their effectiveness cannot be understood out of the context of the national innovation systems.[69] The strengths and weaknesses of the NIS represent a framework within which the policy objectives and the ensuing portfolio mix can be evaluated. The institutional context within which the innovation policy objectives are defined

[66] Tomas Åström et al. (2006), "Strategic Evaluation on Innovation and the Knowledge Based Economy in Relation to Structural and Cohesion Funds for the Programming Period 2007-2013: Sweden", Technopolis, p.15.

[67] Stephanie Monjon and Patrick Waelbroeck (2003), "Assessing Spillovers from Universities to Firms: Evidence from French Firm-Level Data", *International Journal of Industrial Organization*, Vol. 21. pp 1255–1270.

[68] OECD (2006), "Peer Review of the Policy Mix For Innovation in Poland", Draft of the Country Background Report *Poland, case of the catching up country.*

[69] P. Boekholt et al (2001), "An International Review of Methods to Measure Relative Effectiveness of Technology Policy Instruments, Final Report, July 2001, Technopolis.

explains why in most countries these objectives are still defined very ambiguously.[70] A majority of countries still do not set clearly defined objectives and link them to measures expected to lead to the achievement of the objectives. However, some countries do use output type indicators as targets: the Netherlands is a good practice case in terms of target setting.[71]

As noted, the policy mix of the UNECE catching up economies has notably changed between end of the 1990s and early 2000. Until the mid-1990s policy was focused on bridging institutions with the aim to commercialize results of past R&D. A common assumption was that there is an untapped reservoir of technology in research institutes both inside and outside academia. According to this view, all that needs to be done is to transfer this know-how potential to enterprises. This justified support to S&T parks and similar intermediary organizations which in theory should facilitate the transfer of technologies 'ready for commercialization'. A policy push in this direction came also at a time when R&D institutes and universities could gain extra financial resources while their traditional sponsors – governments – were operating under strong financial constraints.

Box C.2.5 Country experiences: Policies to bridge sources and users of innovation and their effectiveness

In practice, the size and nature of the implementation gap – that is, the gap between sources and users, or the market, of innovation – remains a huge problem within this policy framework. The 'catalogue of innovation developments recommended for introduction', still published by Ministries and different organization in many EECCA countries illustrates the problem. A careful analysis of such catalogues would show that only small percentage of developments are ready for introduction from the technical point of view. Interviews with local specialists who are familiar with technology market also suggest that only one a few of R&D results from these extensive lists would be interesting from a commercial point of view. In view of this, the experience of various countries with policies to bridge the sources and users of innovation may be relevant.

The 'Smart Mix' scheme to promote collaboration between knowledge users and knowledge producers in the Netherlands[72] is a new measure which aims to promote focus and mass in scientific research and to enhance the valorization of results from research. Smart Mix addresses the 'knowledge paradox' by stimulating collaboration between the business sector and the knowledge infrastructure in specific key areas that are, or will be, strategically important for the Netherlands. The scheme aims to improve interaction and collaboration between knowledge users and knowledge producers in a large part of the knowledge chain. Each programme is carried out by consortia of companies, social organizations and knowledge institutes. The composition of the consortia varies with the type of orientation. The instrument has an annual budget of 100 million euros and is set up by the Ministry of Education, Culture and Science and the Ministry of Economic Affairs as a joint effort to avoid the fragmentation of research funding and to strengthen demand-orientation within research infrastructure. The programme is managed by the Smart Mix secretariat, which is established by the national research council NWO and the innovation agency SenterNovem.

In Spain, the CENIT programme finances large-scale research projects of a strategic character in areas with significant technological potential on the basis of public-private partnerships. The scale of the

[70] EC (2006), *The European Innovation Progress Report 2006*, DG Enterprise and Industry, (available at http://trendchart.cordis.lu/Reports/Documents/EIPR2006-final.pdf).

[71] Alasdair Reid (2007), "Science & Innovation in the 21st Century: Lessons for European Core and Peripheral Economies", Paper presented at the Conference: 'Why Invest in Science in South-Eastern Europe?', Ljubljana, 28 September 2006 (forthcoming as chapter in UNESCO Proceedings volume).

[72] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: The Netherlands, 2006*.

projects dictates the need to gather the efforts of many varied agents. An additional explicit aim of this initiative is to encourage a culture of cooperation between the different actors of the national innovation system. The projects are implemented by a consortium, formed by at least two large or medium enterprises, two small and two research organisations, with the latter accounting for at least one quarter of the total costs. Grants could cover up to half of the value of the project, within a range of 5-10 million Euros. A complementary measure within this scheme provides for work of post-doctoral students in companies, being managed by the Ministry of Education and Science.

So far there has been only limited number of programmes specifically supporting collaborative projects in the Czech Republic involving more partners. The programme for national support of Nanotechnology for Society (AS CR) has as its objective the creation of a platform including AS CR, universities, and the industrial sector in the Czech Republic as a way to ensure the long-term development of this area of science. The TANDEM (MIT) programme aims at improving the cooperation of industrial organizations with research workplaces (academic, university, and other ones), the theoretical and technological support of small and medium-size enterprises, the improvement of the competitiveness of future products and technologies, and more efficient transfers of results of the basic research to industrial applications. The Research Centres (MEYS) programme seeks to gather all important research capacities within centres that will provide for effective transfer of knowledge among individual research stages to the entities that use them.

The U.S. Federal Technology Transfer Act of 1986 made technology transfer an explicit responsibility of all Federal laboratory scientists and engineers, and it authorized the use of cooperative research and development agreements (CRADAs) so that Federal laboratories could partner with industrial firms at the R&D stage. The program entitled 'Users Group for the Dissemination and Adaptation of Generic Technologies' in Israel is designed for the dissemination and adaptation of new generic technologies that were developed in Israel or abroad, and which are useful to any group of industries organizes as a users group. Turkey is implementing a Scientific and Technological Cooperation Network and Platforms Support Programme, targeting national and international enterprises, public research institutes and scientific communities. Interested parties are encouraged to form a coordinating organisation to present a project proposal that could be financed by up to 50 per cent of eligible costs. The aim is to support collaboration in R&D but also to promote the involvement of Turkish researchers in European Technology Platforms, which have provided the inspiration for this programme. In Switzerland, R&D consortia aim to pool the competences of the public research sector with the demands and expertise of the private sector to develop new products or processes. Public financing is performance related and depends on the outcome of the project, assessed on the basis of a number of parameters previously defined.

Policies focused predominantly on bridging institutions assume that the problem of innovativeness of the economy could be solved within the logic of this type of 'linear innovation model' (on some of the lessons learned see Box L.2.3). But, how far can R&D institutes be pushed to substitute for firms by commercialising results of their R&D? Could the solution be in re-framing the problem and orienting policy more towards problems of innovation within industrial firms? A linear innovation model ignores the importance of innovation within the business and production process. Enterprises are not seen as sources of supply of technology but only as sources of demand for technology. Commercialization is seen as activity that does not bring anything technically new for innovation. Technical problems of commercialization are considered as inferior to the R&D problems. All of these problems affect negatively the effectiveness of this type of innovation policy.

In contrast to these popular perceptions, recent innovation studies show that firms need a highly specific kind of knowledge in order to solve their problems. Except where academic departments have developed areas of applied expertise, academic knowledge outputs may be either too general or too theoretical and fundamental, and thus too long-term to be easily usable. The knowledge applied by commercial enterprises tends to be firm-specific and cumulative. The cost of assimilating knowledge and technologies from outside a firm in order

to incorporate them is very high, and the idea that academic research is a pool of free knowledge that can be tapped with limited costs is not sustainable. Where industrial enterprises do have links with academic research, these generally involve long-term relationships and financial support for the academic research from the firms, and are not dependent on close proximity between firms and academic institutions.

Box L.2.3 Lessons learned in bridging and linkages policies: collaborative models

The systems of knowledge production in modern industries (notably, in the ICT related sectors) has been transforming towards distributed systems meaning that a variety of new organizations, in particulars users, have become involved in the innovation process. This new collaborative mode of innovation where users become as important as producers contributes to the improvement of technologies, reduces the dependency on suppliers, and promotes universal interoperable technologies. Among the important agents in this process are the so called 'knowledge communities' which cut across the boundaries of conventional organizations (businesses, research centres, public and government agencies, etc.) and members of the former are at the same time employed by the latter. Such communities are to be found most often in software development where sophisticated software users with a need for better solutions – not proprietary software developers – have been the dominant innovators. In addition, there is an increasing recognition that such communities may develop in sectors like health and environment. A key novelty is that new ideas and methods do not necessarily flow from suppliers. Instead, users interact in the design and building of innovative products for their own use and freely reveal their design to others. Others then replicate and improve the innovation that has been revealed, and freely reveal their improvements in turn. However, as pointed by in an OECD study,[73] "doing" is not enough to be an innovator and to contribute to create a horizontal system of innovation. Three other conditions are important: least some users have sufficient incentives to innovate; at least some of these innovators have an incentive to reveal voluntarily their innovations; they are able to diffuse innovation at low cost.

This change in sources of innovation opens an entirely new area for innovation policy in the UNECE economies which has not yet been explored, in particular in the catching up UNECE economies. So far, one can only point to a few relevant policy issues which arise from this important new trend. First, policies discriminating against users undermine an economy's ability to innovate and grow. Hence, policy should encourage user-led innovation, both by publicising its possibilities and by removing barriers to its introduction. This may include revisiting the schemes by which subsidies are allocated to manufacturers, ensuring that there is a level playing field in support for manufacturers and users when it comes to research, development and innovation, etc.[74] Another important policy issue is the users' involvement in the implementations or services and the role of users as standard-setters. Users may play an important role in standard-setting processes thereby contributing to the shaping of newly developed technologies. However, for the UNECE catching up economies this may not be the area of their major involvement as these countries are very often involved in technology imitation and adaptation activities. Nevertheless, users from these economies may play an important role in the global innovation process by offering advanced localised solutions based on generic solutions of global technology providers.

The new collaborative innovation models also call for new paradigms in linkages and networking in general. These issues are partly addressed in the European Commission's voluntary guidelines for universities and other research institutions to improve their links with industry across Europe.[75] These

[73] OECD (2004), *Knowledge Management Innovation in the Knowledge Economy. Implications for Education And Learning*, Paris: OECD, Centre for Educational Research and Innovation.

[74] Eric von Hippel (2004), "Open Source Projects as Horizontal Innovation Networks – By and for Users", www.oecd.org/edu/km/mappinginnovation; Eric von Hippel and Michael Schrage (2007), "Users are Transforming Innovation", *Financial Time*s, 10 July 2007.

[75] EC (2007), Commission staff working document accompanying communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, *Improving Knowledge Transfer between Research Institutions and Industry across Europe: Embracing Open Innovation – Implementing the Lisbon agenda*, {COM(2007) 182 final}.

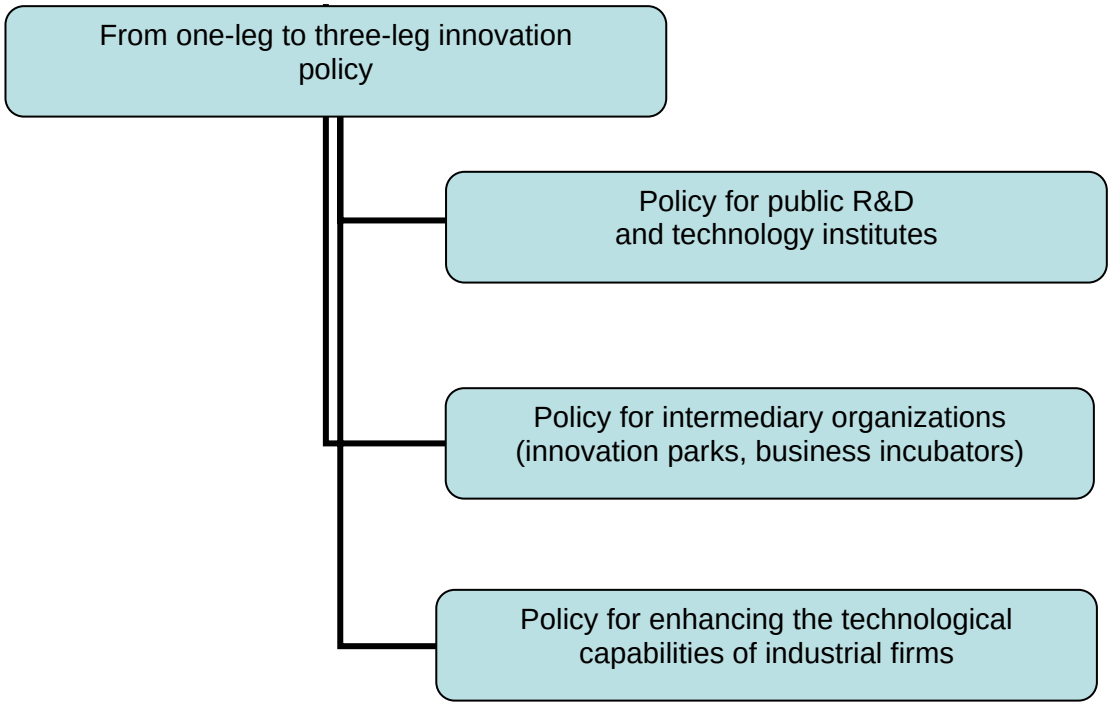
guidelines are based on the assumption that the development of the knowledge economy is inducing a paradigm change in the innovation process, known as "open innovation" and characterized, among other features, by more collaborative research and sharing of knowledge and intellectual property. In that context, universities and other research institutions have a critical role to play provided that certain principles and good practices are observed. These guidelines aim to help research institutions develop more effective mechanisms and policies to promote both the dissemination and the use of publicly-funded R&D results. The first part of the guidelines relates to issues which should be addressed by research institutions in order to ensure that their policies relating to IPR, incentives and conflict of interest optimize knowledge transfer activities, i.e. promote the use of publicly-funded R&D results by industry, while remaining compatible with the research institutions' missions of education and dissemination of knowledge. The second part of the guidelines presents good practices specifically relating to contractual arrangements which, in the broad context defined above, should be taken into account by all staff who negotiate research collaboration contracts.

During the 1990s, innovation policy in the catching up UNECE economies was still largely focused on the *R&D system as supply side* and on the *linkages* between R&D and industry. These linkages emerge in diverse formats as scientific centres that coordinate goal-oriented programmes, and on S&T parks as places of commercialization through new-technology-based firms. The implicit assumption is that the problem is not associated with deficiencies in public R&D organizations and/or in mismatch with demand from firms but with the *links* between them. These two aspects of innovation policy are essential, but they are not sufficient. However, when confined to this aspect, innovation policy has limited scope, predominantly concentrating on the capabilities and resources of scientific, technological and training institutions that undertake technological activities *on behalf* of industrial firms. Thus policy does not cover measures designed to strengthen the technological activities *of firms* themselves as well as mechanisms designed to increase firms' abilities to implement *their own* technological learning; strengthen *their own* design, engineering and other technology development capabilities; or undertake *their own* innovative activities. Moreover, traditional innovation policy in the catching up UNECE economies was predominantly focused on 'mono-structural' framework, centred largely on public institutions as the vehicles for implementing industrial technology development policies. Funding of innovation projects undertaken to solve the innovation problems of enterprises started relatively late, in early 2000.

However, this philosophy is now changing and Figure 1 summarises the shift from one-leg to three-leg innovation policy which has been taken place in the catching up economies between the late 1990s and early 2000s.

During the 2000s, the policy models that place public institutions at the centre of the technology development process have been gradually abandoned, along with images that identify such institutions as the 'supply side' of technology development or human capital formation. In their place, industrial firms are gradually emerging in the centre; and their crucial role as creators and suppliers, not just 'users', of technology, skills and knowledge is gradually becoming recognised (Box L.2.4).

Figure 1. From one-leg to three-leg innovation policy



Box L.2.4 Lessons learned: Some policy implication of the modern innovation process

It is essential to recognise that the nature of innovation process in the modern economy is changing and these changes have important policy implications for the UNECE catching up economies:

First, there is not just one process of innovation, running from research to commercialization. Rather, new ideas are generated in all stages of innovation, including production. Hence, production should be also recognised as a source of innovation (supply) and not only as a source of demand for technology.

Second, basic research is not the only initiatory stage. Very often ideas are initiated by people facing production problems, and are further explored through cooperative R&D projects between firms and research groups.

Third, research results are used in all stages of innovation, in engineering and production. Research results are not confined to the stage usually defined as 'implementation' ('*vnedrenie'*). Hence, cooperation between R&D institutes and firms occurs at a number of points, and is not just about 'implementation'.

Fourth, users are very often more important sources of ideas and solutions than basic research. For firms, this applies, in particular, to linkages with buyers and suppliers. Innovation surveys have shown that links to suppliers and buyers are a more important source of innovation ideas than linkages to R&D institutes and universities. Policy should recognise this by supporting all linkages that matter for innovativeness of firms.

Fifth, linkages between science and production are complex, and are not only in the demand for research, but also related to a range of technical and problem-solving issues. Most often, R&D organizations provide firms with problem-solving expertise, rather than with applied R&D and ready-made innovations. The relationships are primarily people-centred transfers of existing knowledge rather than contract R&D. With the recovery of industry in majority of the catching up economies, there is a

recovery of demand for services rather than for applied research. The share of S&T and knowledge intensive services within the activities R&D system is increasing. This change fits in quite well with the logic of the alternative interactive innovation model.

Sixth, more important than levels of R&D performance for an understanding of the innovation process are the characteristics of the innovative activity that occurs in each sector.[76] In this respect there are important differences between individual manufacturing sectors as well as between manufacturing and services. Innovation in technology-based services sectors relies much more on purchase or license products and services as inputs that incorporate others' R&D, as opposed to conducting R&D for these inputs internally[77].

The policy mix in the catching up economies is still evolving and not all of the new developments outlined in Box L.2.4 are fully taken into account but in any case there are significant departures from very narrow policy mix that prevailed until mid-1990s. A tentative summary of this evolution that these changes have taken place in several dimensions:

- a shift of policy from a strong focus on support to science and commercialization of science results towards broader policy mix which focuses on business innovation and competitiveness;
- a gradual shift from institutional to competitive funding of public R&D;
- from exclusive focus on academy - industry links towards expanded focus on intra-regional and cluster linkages;
- a shift from complete absence of evaluation towards some recognition of evaluation as an important ingredient of policy process;
- a shift from neglect of R&D/GERD expenditures towards overly strong emphasis on this ratio, particularly in relation to Lisbon/Barcelona objectives in the new EU member states.

However, the policy mix in the catching up economies is still overly R&D-focused and traditional in the sense that there is strong bipolar policy model or separation of policy responsibilities between education/science and innovation/industry.[78] Therefore, the forward-looking policy design, especially in the context of the recent evolution in the understanding of innovation and competitiveness policies, should also strike a balance between different principles and objectives (see Box L.2.5):

Box L.2.5 Lessons learned: The effectiveness of the innovation policy mix

The innovation policy mix needs to strike a careful balance between different, sometimes conflicting principles and objectives, such as:

· Balance between *institutional and competitive funding* is important as R&D systems should ensure incentives but also a degree of stability. An excessive emphasis on institution-based financing tends to

[76] Albert N. Link (2007), "U.S. Innovation and Competitiveness Initiatives. White Paper prepared for the UNECE Team of Specialists on Innovation and Competitiveness Policies", University of North Carolina at Greensboro, Department of Economics, June 10, 2007.

[77] Ibid.

[78] See Claire Nauwelaers and Alasdair Reid (2002), "Learning Innovation Policy in a Market-based Context: Process, Issues and Challenges for EU Candidate-countries", *Journal of International Relations and Development,* Vol. 5, No 4.

protect incumbents and creates few incentives to increase efficiency, productivity or innovation. From that perspective, there is a need to shift to greater reliance on competitive allocation and project-based funding. Most of the catching up economies have made some progress in this direction. However, this balance is still skewed towards institutional funding with some exceptions. On the other hand, there is a real danger that systems that formally seem competitive are in practice not competitive, especially in small countries. Probably, what matters more is the quality of both modes of funding, institutional and competitive systems rather than the principle itself. Also, these two principles are not mutually exclusive as block grants can be subject to competitive longer-term funding. Finally, both modes are heavily influenced by assessment criteria which usually favour more 'objective' criteria embodied in scientific publications and much less local knowledge diffusion.

· Balance between *world quality and local relevance* is important in view of several criteria which dynamic R&D system should meet. It should contribute to the generation of new knowledge but equally it should contribute to distributive capability of NIS, that is, its capability to diffuse knowledge throughout the economy. In essence, an effective NIS should ensure a good balance between investing in R&D and investing in knowledge absorption (training and education) and diffusion (technology transfer).

Finding an effective policy mix in these circumstances is not a trivial task. An OECD report identifies three rules of thumb on the effectiveness of the policy mix:[79]
· First, the development of specific innovation-support instruments should be undertaken within the context of an overall strategy that is coherent and well coordinated, i.e. within a well balanced and feasible policy mix.
· Second, specific innovation policy programmes should be treated as learning experiments and hence external monitoring and evaluation of programmes are crucial. Ideally, programmes should be introduced on a pilot basis and then closed if failed or up scaled if proven successful. The large number of measures and the large number of actors involved raises the risk of duplication of effort, on the one hand, and very slow decision-making on the other.
· Third, it is essential not to overload strategies with too large number of under-funded projects. 'The multiplication of innovation-specific measures raises the risk that initiatives will be under-funded and/or lose momentum very rapidly.'[80]

2.4 BUILDING SYSTEMS OF INCENTIVES FOR SUPPORT FROM KEY CONSTITUENCIES

The strength of the organizations that form the NIS, the pressure that they exert in favour of innovation and their degree of success in aligning their interests can greatly explain the level of development of innovation policy in individual countries. For example, the existence of large enterprises active in business R&D reduces the need for government and science and technology (S&T) infrastructure to compensate for weak in-house R&D and thus reduces the pressure for innovation policy. An economy dominated by a large number of SMEs raises the demand for innovation policy to complement their technology activities through developed technology infrastructure.

During the 1990s, the pressure for innovation policy in the catching up UNECE economies has increased as the average size of enterprises has decreased and is now below the average in developed market economies. An economy dominated by FDI requires different type of innovation policy depending on whether foreign MNCs are active as innovators or are primarily confined to low cost operations. These differences in the 'innovation constituency'

[79] Based on Christian Gianella and William Tompson (2007), "Stimulating Innovation in Russia: The Role of Institutions and Policies", *OECD Economics Department Working Papers*, No. 539, Paris: OECD.

[80] Ibid, p. 24

strongly determine the nature of demand for innovation policy. In particular, benchmarking of innovation policies would have to take into account the differences in 'innovation constituencies' when assessing the levels and effectiveness of different innovation policies.

Cross-country differences in innovation policy generally arise primarily due to: a) differences in the development of the 'innovation constituency', and b) differences in the activism and attitude of the state. For example, a weak innovation constituency in some SEE countries when coupled with the lack of state activism and the lack of push from the EU has resulted in some cases in a complete absence of innovation policy. On the other hand, in countries where, due to the high share of business R&D, the innovation constituency is relatively strong, and where the state has visible interests in innovation promotion and has been facilitated by the EU activism in innovation policy, one observes quite developed innovation policy (for example, the Czech Republic, among others). During the pre-accession phase in the NMSs, the previously weak and dispersed innovation constituency was initially supported via programmes of technical assistance, participation in technology diffusion programmes (such as the Relay Centers) and Framework Programme activities which are now followed by more sizeable investments via the structural funds.

Box C.2.6 Country experiences: Innovation and competitiveness constituency

The innovation constituency in different countries has taken a different shape and there are no common patterns. The experiences in the different countries largely reflect the national specificities.

One of the specific features of the innovation constituency in Denmark is the strong stakeholder involvement in the formulation of innovation policy.[81] In addition, there is a strong tradition of consensus regarding innovation policy in this country. For this to materialise, there is interaction among all key stakeholders and consultation and partnerships are increasingly put onto the agenda. There is also coordination among the different organizations involved in policymaking related to innovation and recently inter-ministerial committees were established to further improve coordination. The most important recent example of stakeholder involvement is the establishment of the Globalization Council, where stakeholder involvement has been institutionalised. In general, there is no separation between policy design and policy implementation. The ministries involved in policy formulation are also in charge of the implementation in most cases.

The innovation constituency in Germany is often regarded as an integral component of German innovation governance.[82] One of the perceived strengths of the German innovation governance system is its evidence-based policy making, supported by a strong involvement of stakeholders from industry and science and regular foresight activities. Furthermore, the long established and well-functioning system of informal coordination among policy makers is a strong asset and seems to be superior to systems relying on fixed coordination structures that often involve a high level of bureaucracy and inflexibility. At the same time, though, there are also some weaknesses related to this mode of operation. One of them is the rather complex federal system which implies the need to coordinate among a very large number of stakeholders.

Business civil society networks that act in favour of innovation are organizations like the Polish Entrepreneurship Council, established in 2003 as the first attempt to create a platform of addressing common interests to the legislative and executive state institutions with regards to the state economic policy. Also, organizations like Consultation and Advisory Points (for SMEs) operate as centres, in which entrepreneurs may receive free and general information on starting and pursuing economic

[81] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Denmark, 2006*.

[82] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Germany, 2006*.

activity, including legal aspects; information on access to financial means, advanced advisory services, utilization of the EU funds.

The Council on Competitiveness in Ukraine (CCU) is a non-profit, non-governmental organization, which aims to coordinate the efforts of academics, entrepreneurs (both managers of large companies and representatives of SMEs) as well as representatives of the governmental and the legislative bodies to promote policies targeting the national competitiveness. The promotion of innovation and knowledge-driven development is a key component of the work of CCU. The main operational principle of the CCU is the search for a core consensus (through discussions, seminars, conferences and other forms of communication) among key stakeholders on important policy issues relevant to innovation and competitiveness. In this context, the Academy of Sciences of Ukraine has proposed a programme targeting the increase of competitiveness, which is also a platform for dialogue between the public authorities, academia and the business community. Increasing competitiveness is proposed as a "national idea" that can serve to galvanise common efforts to drive the necessary institutional and economic transformations. Thus, the implementation of the programme is seen as the materialisation of a social contract between the various stakeholders.[83]

The setting of objectives in innovation and competitiveness policies largely depends on the nature of the country's innovation and competitiveness constituency (see Box C.2.6). In addition, the development and the nature of the policies is not only a reflection of the constituency but also reflects the political economy dynamics of policy making in the individual country. That is, the dominant view on policy will also reflect the capacity of the innovation constituency to legitimize and supports its own interests in the process of policy formation. This legitimization occurs in an environment where there is either scepticism about the necessity and possibility of innovation policy or where that policy is seen as necessary and possible or where there is some intermediate form of these two views.

The catching up economies are characterised by strong dynamics in this respect whereby a generally weak innovation constituency is trying to expand its field of action. Eventually, the complexity of these factors will be reflected in the policy mix or in the combination and balance of policy instruments that are used to achieve the desired innovation objectives. These mixes may be such combinations of instruments that they operate in complementary and mutually reinforcing ways or they may be uncoordinated and conflicting mixes that may reflect opposing special interests.

2.5 IS THERE CONVERGENCE IN THE SETTING OF OBJECTIVES?

The accession of a large group of NMS into the EU has strongly affected their policy making with important consequences for the objectives of innovation and competitiveness policy and the related policy mix. The accession has led to the broadening of the policy mix, the strengthening of the human resource issues in the mix and recognition of the importance of business innovation. Put differently, it has contributed to a process of convergence of their innovation policies to those prevailing in the EU, or their 'Europeanization' (see Box C.2.7).

[83] Institute of Economy and Prognosis of the National Academy of Sciences of Ukraine (2007), *Concept of the State Programme for the Increase of Competitiveness of the National Economy in 2008-2015*.

Box C.2.7 Country experiences: The "Europeanization" of innovation and competitiveness policies in the NMSs

For example, the Polish Strategy for Increasing the Innovativeness of the Economy for 2007-2013 includes the following key areas as axes of its innovation policy:[84]

Axis: Human Resources for modern economy
Strategic area 1: The development of life-long learning
Strategic area 2: The transfer of knowledge between the R&D sector and entrepreneurs through an exchange of human resources
Strategic area 3: Innovation as an element of the education system adjusted to the requirements of modern economy
Strategic area 4: The promotion of entrepreneurship and innovation

Axis: Research for the economy
Strategic area 1: Financing scientific research and development works of enterprises
Strategic area 2: Focusing the public financing on research in strategic areas based on the needs of enterprises (including technological foresight)
Strategic area 3: Restructuring the public R&D sphere
Strategic area 4: Internationalization of scientific and innovation activities - European integration

Axis: Intellectual property for innovation
Strategic area 1: Support for intellectual property management
Strategic area 2: Support for entities which register patents abroad
Strategic area 3: Improving the process of obtaining protection in the area of industrial property rights
Strategic area 4: Industrial design as a source of gaining competitive advantage

Axis: Capital for innovation
Strategic area 1: Facilitating the access to funds for innovation activities
Strategic area 2: Support for enterprises based on modern technologies
Strategic area 3: The application of tax instruments encouraging the increase of expenditure on innovation activities

Axis: Infrastructure for innovation
Strategic area 1: The development of institutions providing advisory and technical services for innovative entrepreneurs
Strategic area 2: Support for networking of entrepreneurs aimed at implementation of innovative undertakings
Strategic area 3: Strengthening the co-operation between the research and development sector and the economy
Strategic area 4: Promoting the use of information and communication technologies

The Polish programme, which defines the activities to be co-financed from the EU Structural Funds (Development of the Polish economy on the basis of innovative enterprises), defines the following key priority areas:
· Improvement of innovativeness of enterprises.
· Improvement of competitiveness of Polish science.
· Strengthening of the role of science in economic development.
· Increasing the share of innovative products of the Polish economy in the international market.
· Creation of permanent and better workplaces.
· Growth of the use of information and communication technologies in the economy.

The Innovation Strategy of Bulgaria includes measures that correspond to the established European practices and aim at stimulating the development of all innovation spheres on a project basis.[85] These measures are classified into two groups:

[84] *The Strategy for Increasing the Innovativeness of the Economy for 2007-2013*, 19th August 2006. Warsaw: The Ministry of Economy, The Economy Development Department.

1. Financial measures:
• Project financing of innovation and technological development through the National Innovation Fund and encouraging partnerships and public-private cooperation;
• Creation of new and/or enlarging existing technology centres to provide more and better opportunities for technology transfer to and from the business sector;
• Additional financial stimuli to innovators
2. Non-financial measures:
• A continuous dialogue among all stakeholders in the process of knowledge creation and diffusion;
• Entrepreneurial training;
• Establishing clusters to activate the vertical and horizontal integration of the value-added chains;
• Adopt of EU indicators for measuring the innovation potential of enterprises;
• Attracting FDI in the field of R&D and encouraging the related transfer of technology;
• Support existing technology parks and setting up new ones;
• Organize centres for entrepreneurship at universities to teach modern business practices.

The Czech National Innovation Policy has established the following four main objectives: [86]
· Strengthening of research and development as the source of innovation;
· Creation of functional cooperation between the public and private sectors;
· Efficient procurement of human resources for innovation;
· Making the performance of the state administration in R&D and innovation more efficient.

However, some objectives have been uncritically adopted in the NMSs without duly taking into account the fact that they are still catching up economies. In particular, there seems to be an overemphasis on the importance of IPR-related issues. This is largely driven by the European Innovation Scoreboard framework which has been adopted also as a policy framework and which includes patents as important components of the country's innovation capability.

Past experience of Europeanization in other, previous EU entrants, shows that the strongest effects were on problem definitions, that is, what is in defining what are the country priorities, and what is the relevant policy action and mechanism. In the case of the NMS, this is compounded by the great importance of funding coming via the Framework Programmes and the Structural funds. There is a risk of some kind of myopia where local problems and search for local solutions may not be appreciated to extent that would be needed. The autonomy of the NMSs in R&D and innovation policy may remain formal as in practice the EU may affect the influence of goals, the allocation of costs and the mobilization of resources.

Whether all new NMSs will exploit the opportunities created by Europeanization to modernize their national R&D and national innovation systems and integrate them into EU wide activities will depend on variety of local factors. Europeanization has already brought new activism in S&T and innovation policy and is likely to have significant positive effects on the restructuring of their innovation systems. In that respect, the Europeanization may have stronger effect on building national innovation systems than actions shaped by the state policy. Given the high opportunities, which EU accession entails for the NMS, one may expect that Europeanization will be used as the main tool of modernization of their RTD systems.

---

[85] Innovation Bulgaria (2006), *Innovation Strategy of the Republic of Bulgaria and Measures for its Implementation* (summary), (available at http://www.arcfund.net).

[86] Innovation Czech Republic (2005), *National Innovation Policy of the Czech Republic for 2005–2010*, Prague, June 29, 2005.

CHAPTER 3. POLICY INSTRUMENTS TARGETING INNOVATION-BASED COMPETITIVENESS

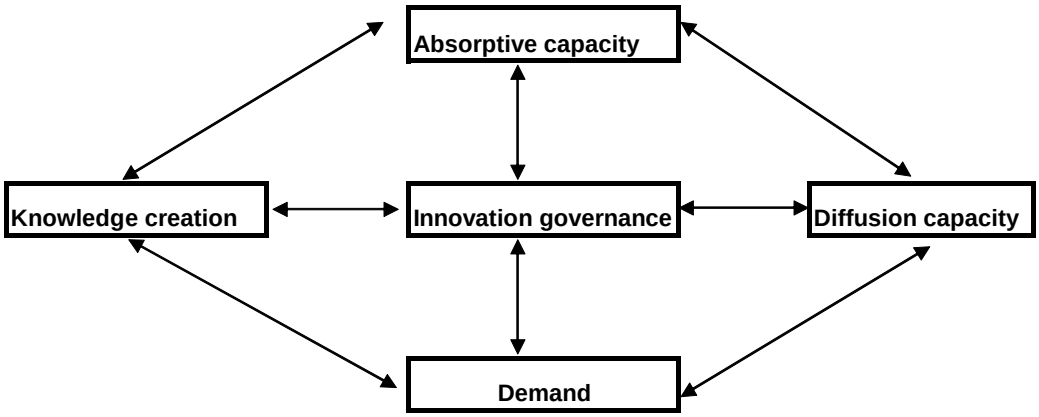
Innovation based competitiveness is multidimensional phenomenon for which knowledge generation is an important but not sufficient condition for innovation based growth. An operational model that allows grasping the multidimensional nature of innovation at country level and its policy aspects, as well as the possibilities to fully utilize the existing potential for enhancing competitiveness and growth, is the notion of national innovation capacity (NIC).[87]

The underlying idea is that the innovation capacity of an economy depends not only on the supply of R&D but also on the capability to absorb and diffuse technology and on the demand for its generation and utilization. From a policy perspective, it is important to bear in mind that innovation capacity also depends on innovation governance, that is, on set of institutions and rules that affect the innovation process.

This *Review* adheres to the understanding that innovation policy is any policy measure and mechanism that affects the innovation process and uses the concept of NIC as an organizing framework to capture this comprehensiveness of innovation policy. Four dimensions of innovation capacity – absorptive capacity, knowledge generation, diffusion and demand – interact with each other through the systems of innovation. National innovation systems, which are able to create synergies between different dimensions of innovation capacity, are better in promoting innovation and economic growth based on innovation capacity. In this section, we analyse the role of innovation governance as a core dimension of the national innovation capacity.

Figure 2 presents graphically the elements of the innovation capacity conceptual framework. The individual elements of the framework are interrelated and, in aggregation, generate the national innovation capacity.

Figure 2: National innovation capacity



[87] Slavo Radosevic (2004), "A Two-Tier or Multi-Tier Europe?: Assessing the Innovation Capacities of Central and East European Countries in the Enlarged EU", *Journal of Common Market Studies*, Vol. 42, No. 3, pp. 641-666.

The absorptive capacity is the ability to absorb new knowledge and adapt imported technologies.[88] This capability is essential if catching-up economies are to grow and innovate. The R&D capability is important not only to generate new knowledge but also as a mechanism to absorb it.[89] Diffusion is the key mechanism for reaping economic benefits from investment in R&D and for increasing the absorptive capacity.[90] The demand for R&D and innovation is the key economic mechanism that initiates wealth generation processes in R&D, absorption and diffusion activities.[91]

Innovation based growth is an outcome of complementarities between framework conditions and developed elements of NIC. Framework conditions are shaping each of the elements of NIC but they are not sufficient to understand the relationship between growth and innovation. For example, significant incentives for enterprises to invest in cleaner, more energy-efficient technologies will be not sufficient unless there is a system that supports innovation and technology transfer. In other words, favourable framework conditions will have to be coupled with the NIS proper, that is with developed elements of the national innovation capacity.

The NIC concept is useful both in organizing the discussion of different aspects of innovation and competitiveness policy and as a kind of reference policy mix. Thus Table 1 summarises some of the main innovation policy measures undertaken in the NMSs, grouped in these four main categories of measures.

Table 1: Number of innovation policy mechanisms in the NMSs (as of end-2003)

	Absorptive capacity and human capital	Generation of new knowledge (R&D)	Diffusion of knowledge and networking	Demand for R&D and innovation	Total
Bulgaria		1	1	1	3
Czech Republic		4	4	3	11
Hungary		3	3	4	10
Estonia	1	3	5	1	10
Latvia		1	2	1	4
Lithuania	1	2	1	1	5
Poland	1	3	1	3	8
Romania		2	2	4	8
Slovakia		2	2	1	5
Slovenia	3	4	5	2	14
Total	**6**	**25**	**26**	**21**	**78**

Source: Slavo Radosevic (2004), "Innovation Policies in Central and Eastern European Countries: Are They Meeting the Challenges of Knowledge-Based Growth in Enlarged EU?", In Andrzej H. Jasinski, (ed): *Transition Economies in the European Research and Innovation Area: New Challenges for Their Science and Technology*, Warsaw: Wydawnictwo Naukowe Wydzialu Zarzadzania Uniwersytetu Warszawskiego, pp. 95-114.

[88] Wesley M. Cohen and Daniel A. Levinthal (1989), "Innovation and Learning: The Two Faces of R&D", *Economic Journal*, Vol. 99, No. 397, pp. 569-596.

[89] Wesley M. Cohen and Daniel A. Levinthal (1990), "Absorptive Capacity: A New Perspective on Learning and Innovation", *Administration Science Quarterly*, Vol. 35, No. 1, pp. 128-152.

[90] Stephen W. Davies (1979), *The Diffusion of Process Innovations*, Cambridge: Cambridge University Press

[91] William Easterly (2002), *The Elusive Quest for Growth. Economists' Adventures and Misadventures in the Tropics*, Cambridge, MA: The MIT Press.

3.1 POLICIES TARGETING THE ABSORPTIVE CAPACITY

The absorptive capacity denotes all activities that contribute to the successful absorption and adoption of technologies either new or known to the firm and to the country. Proxies for these capabilities are skills and experience of employees and their educational levels.

As pointed out by some authors, 'the national differences in what people do and learn at their workplace is a major factor structuring the national innovation system and affecting its performance'.[92] There are nationally specific systems of the competence building in workplaces which are key to a country's absorptive capability. In countries at lower levels of per capita incomes (the majority of the catching up UNECE economies), a large proportion of the workforce works in either simple or Taylorist organizations while in higher income economies more workers are employed in what is called 'discretionary learning contexts'.[93] However, there is still insufficient knowledge of the national differences in levels and types of learning systems at the micro level.

It is assumed that the catching up UNECE economies have in general relatively higher levels of human capital than would be expected given their levels of development. The structure of education in these countries is compressed on the edges, with low shares of both least educated people and people with high education, that is, the workforce is dominated by blue collar skills. A high share of the population with secondary level education has undergone vocational education and their skills are relatively specialized. This may present an advantage in productivity increases based on skilled personnel in production. A relatively low share of the economically active population in the majority of the NMSs (except Estonia) with tertiary education may suggest that there are difficulties in absorption and diffusion of new information and communication technologies (ICT) in services and industry. In Russia, tertiary education attainment is relatively high in comparison with OECD countries and the proportion of graduates in science and engineering subjects is higher than in most OECD members. This is one of key indicators of a large gap between absorptive and knowledge generation capability in Russia.

The perceived advantages of the educated labour force in the catching up UNECE economies have been questioned recently by pointing to a presumably low quality of education.[94] The transition period has been characterised by a significant mismatch between the types of skills that workers possess and the types of skills that the new economy demands with significant losses attributed to human capital mismatches.[95] The structure of returns to education has changed in the sense that the 'winners' were the college and university educated and those employed in the business services sector while the 'losers' were those in construction and

[92] Bengt-Åke Lundvall (2006), "Innovation Systems between Policy and Research", Presentation at 'Innovation Pressure Conference', Tampere, March 2006, mimeo.

[93] Ibid.

[94] John Beirne and Nauro F Campos (2007), "Educational Inputs and Outcomes Before the Transition from Communism", *The Economics of Transition*, Vol. 15, No. 1, pp. 57-76.

[95] Viliam Druska, Byeongju Jeong, Michal Kejak, and Viatcheslav Vinogradov (2002), "Assessing the Problem of Human Capital Mismatch in Transition Economies", *William Davidson Working Paper* Number 467, March 2002.

agriculture, those who attained only primary or vocational education as well as those younger workers who acquired most of their education after the collapse of communism.[96]

Despite a favourable structure of the general level of education, there still may be problems of adjustment if the accompanying training and retraining programmes are not adequate. Thus all NMSs still invest less than the EU average in current skills when measured through vocational training. This is in stark contrast to a high share of employment in high-tech manufacturing (especially, the ICT sector). The assessment of innovation policy measures (Table 1) indicates that the area of absorptive capabilities has been largely neglected by policy. By 2003, only four NMSs had established programmes that address the absorptive capabilities (life long learning, innovation management programmes, and young researchers' education). This suggests that reforms are necessary in the training and re-training system for the existing labour force (see Box C.3.1). In particular, this applies to adults with low or obsolete skills and therefore government schemes should be targeted in priority towards these groups. The scope of training provided for unemployed people is meagre. For example, in Poland, unemployed trainees accounted for just 5.2 per cent of the total number of the unemployed plus job-seekers in 2005.[97] Governments could consider establishing a more effective training culture by directing existing subsidies on a competitive basis and according to provider performance.

In addition, training services are most frequently oriented towards groups that could contribute to business innovation like high-ranking managers and directors, as well as workers employed directly in the production processes, particularly in large companies. In Poland, only around 6 per cent of those sent for training are workers with low qualifications. This suggests that training is much less oriented towards absorptive capabilities and relatively more to innovation. A major opportunity for the NMSs in this regard is the implementation of human capital development programmes co-financed from EU funds.

Box C.3.1 Country experiences: Policies targeting the absorption capacity

Denmark: the transformation of the Danish vocational education system[98]

An important strength of the Danish innovation system is the system for vocational and adult training. This system is heavily targeted at upgrading general qualifications, at least the part of the training system which is publicly funded. The policy aim is to improve labour market flexibility by upgrading general skills and to avoid free-rider behaviour of firms if the financing is private. However, in the new business environment there is larger need for co-operation and communication skills etc., which may be learned most efficiently in the specific context in which the persons are expected to co-operate, that is, the firm. This would require a more firm specific training model and changes in the vocational training system in that direction were called for a decade ago. After 1990, the Ministry of Industry initiated a number of steps aiming stated to render the training system more firm specific. This required close cooperation between Labour Ministry and Ministry of Industry. Despite some initial disagreements, over time the

[96] Nauro F. Campos and Dean Jolliffe (2007), "Earnings, Schooling and Economic Reform: Econometric Evidence from Hungary (1986-2004)", *IZA Discussion Paper* No. 2678, March 2007.

[97] Programme (2006), *National Reform Programme for 2005-2008 to Implement the Lisbon Strategy: First Annual Progress Report*, Adopted by the Council of Ministers of Poland on 13 October 2006, p.52.

[98] Jesper L. Christensen (2003), "Changes in Danish Innovation Policy - Responses to the Challenges of a Dynamic Business Environment", In: Peter S. Biegelbauer and Susana Borras (eds.), *Innovation Policy in Europe and the US – The New Agenda*, Aldershot, UK and Burlington, VT: Ashgate, p.93-111.

new system of vocational training has been successfully established and this has brought up positive results.

Programmes for human capital development in Israel[99]

Various government bodies in Israel run different programs aimed at developing human capital for the industry. The objective of the assistance program of the Ministry of Industry, Trade and Labor (MOIT) is to increase the availability of human capital to further industrial development, to internalize an enduring culture of development among factory employees in development areas as an integral part of their daily routine, and to expand the pool of human capital required for the knowledge-intensive and high-tech industries in Israel as a whole. The program assists industry through three separate tracks: Track 1 offers direct assistance to factories in human capital development; Track 2 supports special projects for the development of human capital in cooperation with educational and other institutions; and Track 3 supports the development of human capital for knowledge intensive and high-tech industries throughout the country. The Israel Management Center (IMC) conducts courses and seminars for managers. The Center runs a manager's school and a university framework for postgraduate studies, a program that fosters innovative organizational and management practices in enterprises.

Italy: strengthening human capital formation[100]

The Italian 'Plan for Innovation, Growth and Employment' has as one of its main pillars the improvement of the provision of education. This objective reflects debates with social partners, which have identified the upgrading of human capital as a major dynamic force in fostering competitiveness and growth. The guiding principles of the educational reforms are: increase in the quality of the offer; flexibility and personalisation of study path; adaptability to changing economic circumstances and support to lifelong learning, including for teaching staff. The intended reforms seek better familiarity and availability of technologies in education institutions, the integration of immigrants and other potentially disadvantaged collectives, and special support to scientific degrees, among other goals. In addition, poles of technological formation will be created, pooling the efforts of educational institutions, local authorities, businesses and research institutions.

Slovakia: policies for supporting life-long learning[101]

The low participation by Slovak citizens in the life-long learning has been recognised as important problem of the Slovak education system. By 2005, some 5 percent of Slovaks in the age group 25-64 participated in life-long learning activities, while 10.8 per cent of the EU 25 citizens did so. In April 2007, the Slovak Government passed a new *Life-Long Learning and Advice Strategy*. The Strategy refers to the National Lisbon Programme, proposes a new system of national certification procedures for formal and informal learning. The system consists of flexible learning and advice modules, and relies on an ongoing identification of learning target groups, the assessed needs of the national economy, as well as on forecasting, planning and monitoring of the education processes. Both formal and informal learning systems are supported by the introduction of quality management systems.

Other examples in the NMSs are the: the Action plan for vocational training system (2001-2004) in Estonia, the Programme for training of entrepreneurs linked to innovation in Lithuania, the National systems of support for life long learning in Poland as well as the Programme education for entrepreneurship and the Young researchers programme in Slovenia. In the period since 2003, almost all NMSs have prepared extensive programs which target training and education as part of building country's innovation capacity. These are programs prepared as part of Operational Programs 2007-13 to be co-funded by the EU Structural Funds.

[99] Daphne Getz and Vered Segal (2007), "Creating a Conducive Environment for Higher Competitiveness and Effective National Innovation Systems. Israel", Report submitted to the UNECE, mimeo.

[100] Presidency of the Council of Ministries (2005), *PICO- Piano per l'Innovazione, la Crescita e l'Occupazione*.

[101] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Slovakia, 2007* (draft).

Belarus: policies to develop human capital[102]

The 'State Programme for the Innovative Development of the Republic of Belarus for the Period 2007-2010' defines as one of its priorities the development and upgrading of human resources responsible for fostering innovation. The programme pays special attention to the economic and social working conditions of scientists and, in particular, to the reduction of the potential "brain drain". It envisages improvements in education and training methods, including the creation of state and commercial centres for the training of specialists in innovation management and commercialization of the results from scientific research. The programme also considers the introduction of changes in the curriculum of new courses and other forms of training, such as seminars and conferences to provide a comprehensive system of educational options facilitating innovative development.

Russia: policies of human capital development

In Russia, the shortage of skilled and qualified workers is becoming an important policy issue. A recent report describes the current situation as follows:[103] 'A high and rising demand for educated and skilled workers; an educational and training system that is under-funded below the tertiary level and faced with numerous challenges including deteriorating quality and becoming more responsive to industry's skill needs; an industrial sector experiencing high labor turnover (which inhibits training), constraints on its ability to flexibly adjust its workforce and skill mix, and for some non-competitive enterprises the inability to pay competitive wages to attract and retain needed skills. (These indicators) suggest that most enterprises have not responded to these skill shortages by taking responsibility for training their employees in-house, and training more of them, despite the productivity and wage gains that might come from such investments' (p.41). The high cost of training, training externalities from turnover of skilled workers, and information problem represent key constraints for training.

The authors of the report suggest a number of policy solutions. For example, the government could consider putting in place employer-targeted training policies to remedy the under-investment in in-service training. Its efficient implementation requires to bear in mind: (a) that employers should be closely involved in the governance of levy funds; (b) that policies be designed to increase competition in training provision from all providers, both public and private including the employer; and (c) that levy funds be strictly earmarked for training, and not diverted to other government uses. The authors point out that 'it is important to generate training capacity in enterprises and increase the propensity for workers to undertake training. Grants should not be restricted to state-run training institutions. Funds should strengthen and diversify the supply of training and stimulate demand'. Their conclusion is that whatever training policy is adopted, enterprises and employer associations should have meaningful inputs into the design of the policy so that the training system is responsive to their needs and those of other key stakeholders. At an institutional level, employers in the management of individual vocational and technical institutes should help ensure a steady flow of information to these institutions of what skills are needed by local industry. Employers could also form public-private partnerships to deliver demand-driven, low cost training that is largely self-financing' (p. 46).

The Bolashak Scholarship Programme in Kazakhstan[104]

In 1994, the Government of Kazakhstan established a scholarship programme through which talented young people are fully supported to study abroad in leading institutions, not only at the graduate level, but also at the undergraduate level. Since its inception, the so-called Bolashak Scholarship Programme has benefited more than 2 500 individuals who study or have studied in more than 20 countries. According to official data, nearly 800 of them, upon their return, have held leading government positions and managerial jobs in national companies, represented the country in international organizations, or

[102] Decree of the President of the Republic of Belarus (2007), *Gosudarstvennaya Programma Innovatsionnogo Razvitiya Respubliki Belarus' na 2007-2010 Gody*.

[103] Hong Tan, Yevgeniya Savchenko, Vladimir Gimpelson, Rostislav Kapelyushnikov and Anna Lukyanova (2007), "Skills Shortages and Training in Russian Enterprises", *IZA Discussion Paper* No. 275, Institute for the Study of Labor, April 2007.

[104] OECD (2007), *Reviews of National Policies for Education, Higher Education in Kazakhstan, 2007*, Paris: OECD.

developed domestic businesses. Changes in the regulations for the awarding of scholarships made in 2006 are intended to make the selection process clearer and more transparent and focused. The new regulations also include mechanisms to mitigate the "brain drain" effect common to this kind of initiative.

The main sources of growth in developed market economies are in innovation, knowledge and in the capacity to integrate ICT into business and social processes, and these will increasingly be based on a developed university system. It has been argued that advanced formal training and a strong science base has become a substantial basis for 'learning by doing' and that 'a university mediated trans-national conduit of learning will be of particularly great importance during 21st century for countries seeking to catch up'. [105]

In the catching up economies, pressures on universities to pursue their teaching function through large increases in the number of students participating in higher education puts their knowledge generation and knowledge utilization functions under strain. This, coupled with limited budgets, has in some cases resulted in a declining quality of teaching and has endangered the balance between the universities' three main functions. All this suggests that universities in the catching up economies are not yet able to be key drivers and promoters of linkages in national innovation systems.[106] However, individual success stories do suggest that in some countries one may see the emergence of universities as important drivers of such systems in the near future.

3.2 POLICIES TARGETING THE GENERATION OF KNOWLEDGE

Knowledge generation involves a large set of activities which go beyond R&D. Incremental improvements in products and production techniques, software, design and marketing and active use of new knowledge and new technologies developed elsewhere should be all considered as knowledge generating activities. Traditional indicators of innovation performance are heavily biased toward investments in scientific and technological invention and thus do not capture innovation in sectors like services. Moreover, even within those sectors that they do represent, traditional indicators poorly reflect the true level of innovative activity. This discovery of 'hidden innovation' – the innovation activities that are not reflected in traditional indicators such as investments in formal R&D or patents awarded – has important policy implications.[107] Hidden innovation is often more about absorbing ideas than creating new ones – and is greatly affected by non-innovation policies.

A recent detailed sectoral analysis reveals four types of hidden innovation:[108]

[105] Richard R. Nelson (2004), "The Changing Institutional Requirements for Technological and Economic Catch-up", New York: Columbia University. Paper presented at DRUID's Summer Development Conference 2004, Elsinore.

[106] Slavo Radosevic and Monika Kriaucioniene (2007), "The Role of Higher Education in National Innovation Systems in Central and Eastern Europe", in David Bridges, Palmira Juceviciene, Robertas Jucevicius, Terence McLaughlin and Jolanta Stankeviciute (eds.), *Higher Education and National Development: Universities and Societies in Transition*, London: Routledge, pp. 135-160.

[107] NESTA (2006), "The Innovation Gap: Why Policy Needs to Reflect the Reality of Innovation in the UK?", London: National Endowment for Science, Technology and the Arts, Research report, October 2006.

[108] NESTA (2007), "Hidden Innovation: How Innovation Happens in Six 'Low Innovation' Sectors", London: National Endowment for Science, Technology and the Arts, Research report, June 2007.

- innovation that is identical or similar to activities that are measured by traditional indicators, but which is excluded from measurement (for example, the development of new technologies in oil exploration);
- innovation without a major scientific and technological basis, such as innovation in organizational forms or business models (for example, the development of new contractual relationships between suppliers and clients on major construction projects);
- innovation created from the novel combination of existing technologies and processes (for example, the way in which banks have integrated their various back office IT systems to deliver innovative customer services such as internet banking);
- locally-developed, small-scale innovations that take place 'under the radar', not only of traditional indicators but often also of many of the organizations and individuals working in a sector (for example, the everyday innovation that occurs in classrooms and multidisciplinary construction teams).

In view of this evidence, it appears that encouraging firm-level R&D in sectors that do not innovate through R&D will not necessarily lead to more innovation.[109] Moreover, in broader terms, innovation is defined as a new product or process which is new to the company (or the branch of industry) and which is more productive when seen from a welfare creation perspective.[110] From that perspective, imitation of improved technologies and methods developed in other countries generates new knowledge and very often is essential to innovation. The development of innovation does not primarily depend on the internal resources allocated to R&D but on a far broader set of capabilities that are captured by the concept of 'absorptive capacity' (see below). This capacity is 'a business's ability to identify, assimilate, and exploit knowledge from its wider environment, including the quantity and quality of its networks – be it from other research centres, businesses, or customers'. [111]

The enterprise is a key agent that transforms knowledge and innovation into commercial results. In this process, the enterprise accumulates firm specific knowledge which serves as a basis of its long-term competitive advantage. However, the enterprise is not the only source of knowledge generation for innovation but it relies on partners in its value chain (buyers, suppliers, subcontractors, etc.) as well as on horizontal links with R&D organizations and infrastructure services organizations (consultancies, metrological and standard setting agencies, etc.). Yet, the enterprise is the only organization that transforms technology into products and thus organizational learning within and between firms is essential to the dynamic of the innovation system. Investment in S&T in systems where firms are passive learners has a limited positive impact upon innovation as demonstrated by socialist innovation systems in the past.

In the early years of post-socialist transition, enterprises in the UNECE catching up economies showed little interest in R&D investments, as their financial constraints ruled out this type of investment. Also, unresolved issues of corporate governance inhibited the search for innovation based strategies. In addition, post-socialist enterprises emerged as dominantly production units rather then fully fledged business organizations and hence they were relatively weak entities in terms of their organizational capabilities. Downsizing and break-

[109] Per Koch, Lennart Norgren and Juha Oksanen (2003), *Goodnip - Good Practices in Nordic Innovation Policies: Part 1: Summary and Policy Recommendations*, Oslo: STEP Report 06/2003.

[110] Ibid. p.31

[111] NESTA (2007), op. cit., p. 17.

ups of large enterprises have further contributed to reduced demand for R&D. Large firms are relatively more innovative than small firms and the reduced importance of large firms in all post-socialist countries has contributed to reduced innovation propensity. This was most visible in the closure of in-house R&D departments in the early stages of transition. With the recovery and growth in the late 1990s and early 2000s, this trend has been reversed but in many cases the reversal is not straightforward (see Box C.3.2).

In most NMSs, the process of privatization has enabled a strong dominance of foreign firms while in Russia and other EECCA countries there has been a pattern of domestic-led modernization. The outcomes in terms of innovative performance also differ. Thus in the NMSs, the inward FDI led to fast productivity improvements but narrow specialization of the new subsidiaries. In countries where domestic led modernization prevailed, this process and the process of specialization were somewhat slower, with more restructuring problems. In these countries, a larger share of independent public RTD sector is still in place, which is not yet restructured. Programmes of restructuring of the public R&D sector were applied in some catching up economies where there was political will in early transition (the Czech Republic, Estonia, Hungary). In others (Poland, Romania, Russia) this issue has been prolonged and R&D system can be still considered in 'transition' stage. For example, it is believed that there is a need for a wholesale rationalization of research institutes sector in Romania to equip it for the challenges ahead.[112] In a longer term perspective, a possible solution could be to integrate ex-industrial institutes into industrial enterprises or to universities or transform them into independent R&D services enterprises.

With recovery and growth, innovation activity has strengthened but it is mostly focused on the acquisition of new equipment. Only a small circle of domestic large 'blue-chip' enterprises has shown an increasing demand for R&D. However, the increases in business investment in R&D are still much lower than productivity and growth rates might suggest. The recovery of R&D was relatively more pronounced in the case of public R&D and was mainly focused on upstream areas of R&D.

Box C.3.2 Country experiences: Systems of R&D financing in the UNECE region

There are both similarities and differences in the national systems of R&D financing in the UNECE region. Thus a recent report reveals that a number of countries apply similar policy approaches, at least as regards the approaches to R&D funding.[113] The authors of the report compare the organization of public project funding in six European countries (Austria, France, Italy, Netherlands, Norway and Switzerland) during the last three decades. Their main conclusion is that there is a process of convergence of the national research funding policies towards an allocation model where project funding takes between ¼ and ⅓ of the total public funding (even more in the Norwegian case) and where basically there is a composite mix of policy objectives and instruments. At the same time, there are also instances of instrument convergence, like the Centers of excellence and the large sectoral programs (in sectors such as information technology, genetics, nanotechnology, etc.) that most countries seem to maintain. However, at the same time, this composite model leaves a large room for national specificities concerning the (quantitative) importance of the different rationales, but also in maintaining instruments

[112] Report Romania (2006), "Policy Mix Peer Reviews Country Report: Romania, Second Cycle of the Open Method of Coordination for the Implementation of the 3% Action Plan", Report prepared for the CREST Policy Mix Working Group by Ken Guy, Wise Guys Ltd., in conjunction with IPTS March 2006.

[113] Benedetto Lepori, Michael Dinges, Ruth Mampuis, Bianca Potì, Emanuela Reale, Stig Slipersaeter, Jean Theves, Barend van der Meulen (2006), "Convergence versus National Specificities in Research Policies. An Empirical Study on Public Project Funding", PRIME Network of Excellence, mimeo, 2006.

reflecting national needs and production, like in the case of Norway fisheries, oil and gas, polar environments or in the case of France space research. Moreover, the report also shows that different countries followed an evolutionary path largely based on the reshaping of existing managing structure and, to some extent, on the addition of new instruments alongside the existing ones. As a consequence, when looking at today's organization of project funding, one still finds quite different managing structures which are clearly linked to history and, in particular, to the agencies created before the the 1970s.

Financing R&D in Israel[114]

The Ministry of Industry, Trade and Labor (MOIT) is responsible for several programs aiming to support generic R&D. The objective of the MAGNET program is to provide a competitive position for Israel's industry with regard to state-of-the-art technologies of worldwide interest. New technologies are developed in a cooperative venture between the industry and leading academic scientific research institutions in the area, and provide the basis for new high-tech products and processes. The R&D focuses on new generic technologies that will lead to advanced, new generation products. The industrial partners enjoy a grant amounting to 66% of the approved R&D costs, whereas the academic partner receives 80% of said costs. A foreign company can be included in the consortium. The NOFAR program supports applied academic research that has aroused business interest but is not yet directed at a specific product. The objective is to advance the research to a point at which it is ready for a cooperative venture with a commercial partner. A minimal requirement of this program is for a company or incubator to invest 10% of the development costs, at this stage, complementing the 90% grant given by the government. The Ministry of Science and Technology (MOST) also has several programs for support of long-term national R&D and innovation.

As to the R&D financing in the catching up UNECE economies, some of the main characteristics of their systems can be summarised as follows:
· Relatively low outlays on R&D in relation to GDP. In that respect, these countries have lost their pre-transition specificity when R&D expenditures were ahead of their per capita income levels;
· Predominance of budgetary expenditure and low participation of in-house funding in the structure of R&D financing. This reflects a limited R&D component in innovation expenditures and thus low R&D demand for local R&D from domestic firms.

The involvement of higher education institutions in R&D has produced a kind of divide across different countries. In some countries where historically the higher educations share in R&D has been quite marginal, it has not increased significantly. For example, in Russia in 2005, universities received only about 4.3 per cent of budgetary funding for R&D.[115] In some of the NMSs (Estonia, Hungary, Poland), the R&D systems have become significantly more oriented towards the higher education system. From a long-term perspective this should be considered as a positive development as it will enhance the role of universities as knowledge generators as well as knowledge diffusers. In the short-term, this reorientation has been driven by the lack of demand for R&D in the business enterprise sector, by reductions in public R&D funding, and by large increases in the number of students and hence increased demand for teaching. The issue is whether this trend could be turned into an advantage for universities and an opportunity for the national economies.[116]

[114] Daphne Getz and Vered Segal (2007), "Creating a Conducive Environment for Higher Competitiveness and Effective National Innovation Systems. Israel", Report submitted to the UNECE, mimeo.

[115] Christian Gianella and William Tompson (2007), "Stimulating Innovation in Russia: The Role of Institutions and Policies", *OECD Economics Department Working Papers*, No. 539, Paris: OECD.

[116] Slavo Radosevic and Monika Kriaucioniene (2007), "The Role of Higher Education in National Innovation Systems in Central and Eastern Europe", In David Bridges, Palmira Juceviciene, Robertas Jucevicius, Terence McLaughlin and Jolanta Stankeviciute (eds.), *Higher Education and National Development: Universities and Societies in Transition*, London: Routledge, pp. 135-160.

The systems of innovation in the NMSs have been emerging around international value chains, which are the major sources of productivity improvements in these economies (which are, in general, highly dependent on foreign direct investment). This type of evolution of the national innovation systems poses certain problems for universities and R&D institutes whose links with domestic or foreign enterprises are undeveloped and fragmented. Nevertheless, universities and R&D institutes have been able to develop new functions such as the commercialization of their knowledge and gaining access to foreign R&D funding. However, the limited R&D demand from local enterprises and its 'downstream' character seriously restrict the nature of their links with industry. As a result, the orientation towards commercialization activities has not enhanced the knowledge generation function of the higher education and R&D institutes. In addition, the lowering of teaching quality because of large increases in the number of students has further undermined the link between teaching and R&D as well as between teaching and co-operation with enterprises.

Thus the R&D system of these countries is gradually undergoing transformation into a new type of infrastructure characterized by two parallel shifts:

- a movement towards an enterprise-based R&D system;
- a shift towards diffusion-oriented activities within the R&D system.

A movement towards an enterprise-based R&D system has large effects on what type of extramural R&D is needed to meet the demand from large and small firms for R&D and other knowledge related services. A shift towards diffusion-oriented activities within the R&D system parallels growth based on catching up rather then on frontier R&D. As these countries will need a new sector of knowledge based services, universities, ex-industrial institutes and public R&D institutes are gradually fulfilling these knowledge based services functions by offering problem solving skills, standardization, consultancy and other services. As the role of large firms will be less pronounced than in the past, some R&D activities and innovative solutions may be developed within centres of excellence that will have to establish strong links with entrepreneurs. For example, Poland aims to establish strong network of centres of excellence as a way to consolidate the best R&D potential, regulate its formal status and strengthen their R&D infrastructure.

New technology based firms

New technology based firms (NTBFs) are important agents in dynamic innovation systems. Given their potential as the recipients of new knowledge they play an important role in the process of distributing this knowledge and new technology. What is central to their ability to acquire and assimilate new knowledge is their competence structure.[117] In the spectrum of large-small firms there are two categories of NTBFs. The first category is very much Schumpeterian like firms which are distinguished by high innovative capability, high growth rates and job creation, and intensive market and technology linkages. In the EU context, these high-growth innovative SMEs are called 'gazelles'.[118] Another type of NTBFs are similar to 'gazelles' in terms of their innovative capability and intensity of technology linkages but are not characterised by high job creation. Instead, they operate as specialised suppliers performing an important role in knowledge systems by providing highly specialised inputs

[117] VINNOVA (2006), "In Search of Innovation Systems", VINNOVA Policy VP 2006:02, June.

[118] J. Rigby, M. Bleda, K. Morrison and J.S. Kim (2007), "Mini Study 01 – Gazelles", *Global Review of Innovation Intelligence and Policy Studies,* InnoGrips ProInno Europe.

and services to large firms. Alternatively, they operate as problem solvers for a variety of public and private organizations.

NTBFs firms operate in a regime of technology-based competition where marketing, technical and financial barriers are higher then in the case of cost-based competition. These are areas where barriers for NTBFs from catching up economies are substantial. At the same time, catching up would require a dynamic sector of NTBFs (see Box C.3.3).

Box C.3.3 Country experiences: Supporting NTBFs[119]

Start-up companies in general have difficulties to obtain bank loans because they usually are unable to provide a collateral for the loan. The legal and administrative framework for high-tech start-ups is even less favourable in the catching up UNECE countries due to deficiencies in systems of IPR valuation, protection and commercialization. Public support is underdeveloped and private finance (notably seed capital) for NTBFs is insufficient. Nevertheless, the catching up UNECE economies have been active in trying to enhance new sources of growth by supporting (NTBFs), as evidenced in Russia's programme for supporting SMEs – START.[120] The START program tries to overcome some of these obstacles for new technology based SMEs.

The Program was initiated by the Fund for Assistance to Small Innovative Enterprises in 2003. Approximately half of the Fund's budget was devoted to the START program (in 2006 - approximately 12 million Euros). The Program consists of two steps. The duration of the first step is one year during which the group of researchers or newly created small firm receives "seed" financing (up to about 20 thousand euros per project). The small firm should conduct R&D, develop the prototype, patent their development and work out a business plan. At the end of the first year the firm should demonstrate commercial potential of its product. At the second step, the firm should find a co-investor who is interested in manufacturing of the firm's product or the firm should start own manufacturing of the new product on its own. In this case, it will receive next portion of financing from the Fund. After the two steps, the manufacturing should be actually started, and the Fund stops financing the project.

The most active participants in this program are university researchers: 36 per cent of the applications for the creation of small firms originated there. At the same time, scientists from the Russian Academy of sciences presented 13 per cent of the applications for small firms, the Government Science Centers presented 1.4 per cent, and "others" presented 18 per cent. The remaining 33 per cent of applications came from already-existing small enterprises. In 2005, the first stage of the program was implemented, and about 20 per cent of the start-ups entered the second stage which requires finding non-government financing for the continuation of the work of the firm. Aside of that, the Program raised interest among corporations, and some of them were willing to co-finance the program. At the present time there are some projects implemented in partnerships with companies such as Intel, LOMO, and AFC "Systema".

Similar schemes exist in other countries in the UNECE region as well, both in catching up and developed economies. For example Romania offers tax incentives to IT firms. Hungary has developed a specific programme for the support of start-up companies in technology intensive sectors and also spin-offs supporting the commercialisation of R&D results. The scheme provides grants, which are allocated on the basis of an annual competitive tendering. In Turkey, the Small and Medium Industry Development Organisation (KOSGEB) supports infrastructure and administrative expenditures for new technology-based firms and entrepreneurship under its Start-up Support Programme. France introduced the legal notion of "Young Innovative Company" in 2004. In order to qualify as such, a company should be less

[119] Programmes to support NTFBs are most often focussed on overcoming the specific financings constraints faced by these companies. For a detailed consideration of the associated issues and country experiences, please see the report: *A Comparative Review of Financial Intermediation Supporting the Knowledge-Driven Development and of National Practices Facilitating Access of Innovating Entrepreneurs to Domestic and Foreign Finance*, prepared as part of the CECI programme of work for 2007.

[120] European Trend Chart on Innovation (2007), *Annual Report for Russia*. Report prepared within the framework of INCO BRUIT project (draft).

than eight years old, have a staff of less than 250 people and R&D expenditures should be no less than 15% of the total. Such status confers a number of fiscal benefits, including exemptions on corporate and property taxes. In addition, the employer is not required to pay his share of social security contributions regarding researchers and other technical staff employed by the company.

The experience of Slovenia – as analysed in an innovation survey – provides a different sort of evidence to this effect.[121] This study indicates that larger research institutes in Slovenia co-operate with bigger companies but small institutes hardly enter into contact with small companies. This demonstrates that the innovation participants are not equally integrated in the information and knowledge exchange. Small firms are an important economic element in regional and national innovation systems, but they lack the access to available knowledge since they often co-operate with research institutes to a lesser extent than larger firms. The authors conclude that innovation policy should create incentives stimulating the knowledge and technology transfer and implement measures in order to increase the absorptive capacity and the capability for network management of smaller companies.

3.3 POLICIES TARGETING THE DIFFUSION OF INNOVATION

The importance and variety of related linkages enable innovation to evolve as a systemic activity, implying an important role of the process of diffusion of innovation. Also, the systemic nature of modern technologies requires extensive networking as its organizational basis. With reference to the UNECE catching up economies, the most important linkages in these processes are those between:

- Foreign and local firms (direct, vertical and horizontal linkages);
- Large and small firms;
- Small firms (clusters);
- Research Technology Organizations (RTOs) - industry links.

Facilitating the diffusion of new knowledge through the economy thus calls for policies focused on different forms of partnerships. In R&D, this requires different forms of public-private partnerships which promote knowledge circulation and matching of business needs and R&D expertise. There are different practices in this regard in the catching up UNECE economies such as the joint R&D centres (Poland), long-term cooperation agreements like competence centres (Estonia or cooperative R&D centres in Hungary), networks and clustering schemes (‘*klastry*’ in the Czech Republic) or national technology platforms (Poland).

The links between foreign and local firms in most catching up economies are value chain based and the indirect effects of these relationships are generally estimated to be positive. Horizontal linkages or spillovers are either absent or negative.[122] However, the most

[121] Knut Koschatzky (2002), “Networking and Knowledge Transfer Between Research and Industry in Transition Countries: Empirical Evidence from the Slovenian Innovation System”, *Journal of Technology Transfer*, 27, pp. 27–38.

[122] Beata Smarzynska Javorcik (2004), “Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages”, *American Economic Review*, Vol. 94, No.3, pp.605-627; Joze Damijan, Mark Knell, Boris Majcen and Matija Rojec (2003), “Technology Transfer through FDI in Top-10 Transition Countries: How Important Are Direct Effects, Horizontal and Vertical Spillovers”, *William Davidson Working Papers*, No. 549; Gunther Jutta (2002), “The Significance of FDI for Innovation Activities within Domestic Firms. The Case of Central East European Transition Economies”, Institute for Wirtscahft Halle, Discussion Paper No. 162, May 2002 (http://www.iwh-halle.de/d/publik/disc/162.pdf); Holger Gorg and David Greenaway (2002), “Foreign Direct Investment and Intra-Industry Spillovers”, mimeo, (available at www.unece.org/ead/ffd.htm).

important are the direct effects of foreign firms through high productivity improvements and increased employment. The innovation activities in these countries are to a great extent confined in large firms, which invest into innovation comparable shares of expenditures as firms in the EU. The relatively weak links between large and small firms and between domestic and foreign firms indicate fragmented innovation systems in the catching up economies. The biggest weaknesses are the poor linkages between large and small firms, SMEs being the weakest part of the innovation systems. As an example, the share of SMEs that are innovation active is very small compared to that in the EU. Overall, innovation policy has to strike a balance between supporting integration of local firms into global value chains (FDI, subcontracting) and domestic linkages with universities, S&T parks, cooperative centres, etc.

Inter-firm linkages; promoting the FDI-related diffusion of innovation

Today, no country can rely on knowledge created within its borders. Internationalization of technology is not any more confined to knowledge utilization but also includes knowledge generation. While knowledge generation has never been confined within national boundaries, the degree of internationalization of R&D is constantly rising as part of the trend of offshoring services. R&D internationalization is not longer driven by adaptation to local conditions but by a variety of new pull and push factors and involves complex stages of R&D.[123]

While the UNECE catching up economies still play a marginal role in the globalization of R&D,[124] the internationalization of technology is much more important for them in terms of technology utilization and exploitation. The policy challenge now is how to connect in the most effective way with global R&D networks of TNCs (see Box C.3.4). The ability of a country to benefit from R&D internationalization depends first and foremost on the strength of its NIS. In this context, domestic policies are important in ensuring that foreign investment and strategic partnerships actually support national development. As pointed out by an UNCTAD study, 'the engagement on the part of foreign stakeholders should be seen in the context of domestic policy environment and depends also on the host country's technological capabilities'.[125]

Historically, the catching up economies have been successful in coupling their local technology efforts with technology imports, either via FDI or through arm's length relationships. In principle, the domestic R&D should be integrated with innovation activities of FDI. Failure to build efficient national innovation system may prevent the catching up countries from generating new competitive advantages. In today's terms, this challenge can be interpreted as a need to link value-chain-FDI and NIS. In policy terms, the issue is that of coupling between FDI and innovation policies. For example, issues of relevance are the role of FDI agencies in the innovation process and/or programmes for fostering innovation based FDI and local linkages.

[123] UNCTAD (2006), *World Investment Report: Internationalization of R&D*, United Nations, New York and Geneva.

[124] Ibid.

[125] UNCTAD (2003), *Transfer of Technology for Successful Integration into the Global Economy*, UNCTAD/ITE/IPC/2003/6, United Nations, New York and Geneva.

The empirical studies on spillovers or links between foreign and local firms and their productivity effects demonstrate that there is not general agreement on FDI effects as these are country and sector specific. The direct effects of FDI are generally positive but there is no strong evidence on their exact nature and magnitude. The positive effects of FDI are likely to increase with the level of local capability and competition. The results regarding the indirect effects of FDI are inconclusive. Vertical inter-industry spillovers (backward linkages) are positive while horizontal (intra-industry) spillovers are either nonexistent or negative.[126] There are several explanatory factors for the relatively weak spillovers, in the first place, the fact that linkages take time to develop as well as the weakness of local firms. An outcome of this situation is the creation of an 'enclave economy' and regional inequalities though with strong direct effects of FDI in terms of productivity and employment. Also, transnational cooperation in R&D is still marginal in terms of the overall policy mix. In the NMSs this component of policy is increasing through participation in EU R&D programmes. However, in the majority of other UNECE catching up countries this issue deserves more recognition.

Box C.3.4 Country experiences: Policies targeting the links between foreign and local firms

Israel: encouraging R&D cooperation between MNCs and local partners[127]

The Israeli government has established the Global Enterprise R&D Cooperation Framework with the objective to encourage industrial R&D cooperation between Israeli firms and MNCs. The Global Enterprise R&D Cooperation Framework provides a range of significant incentives for sharing the high risks and costs inherent in high-tech development with the partnering companies. Each and every cooperation model is tailored to the MNC's specific needs and requirements, however, the following basic benefits are maintained in all cases:

· Joint R&D projects between MNCs and Israeli companies are entitled to financial assistance of up to 50 per cent of the Israeli company's approved R&D expenses;

· The government assists MNCs in identifying potential Israeli partners whose products and services may help fill gaps in the enterprise's product line, capabilities and capacity;

· The government provides rapid response and assistance in preparing application;

· The direct investment made by MNCs in R&D projects of Israeli companies can be credited (for tax purposes in Israel), with 150 per cent of the value of such investment.

Special Economic Zones (SEZ) have been introduced in several catching up economies on a large scale as an attempt to diversify production and export structure and stimulate innovation (Hungary, Poland, Russia, among others). The underlying expectation is that firms operating within a SEZ will be able to cut substantially their costs which should enable them to generate increased output, jobs and attract foreign technologies. In both Russia and Poland, the experience with SEZ has not been a very encouraging; however, in Hungary these zones in the form of 160 industrial parks generate some 40 per cent of the manufacturing exports.

Programmes that aim directly to link large and small firms are rare. A good example of this type of programme is the Hungarian *Integrator* which has been discontinued a few years ago due to reasons unrelated to its effectiveness. An "integrator" is a large firm with at least 2 SMEs, who would become

[126] These conclusions do not necessarily hold for Russia. Some studies show that in Russia both vertical and downstream vertical spillovers are significantly negative suggesting that foreign firms in Russia are not yet concerned with building local production networks. At the same time, the horizontal spillover effects for Russia are estimated to be positive. K. Yudaeva, K. Kozlov, N. Melentieva and N. Ponomareva (2003), "Does foreign ownership matter? The Russian experience", *Economics of Transition*, Vol. 11, No. 3, pp. 383-409.

[127] Daphne Getz and Vered Segal (2007), "Creating a Conducive Environment for Higher Competitiveness and Effective National Innovation Systems. Israel", Report submitted to the UNECE, mimeo.

suppliers as a result of the joint technological development project. This programme was initiated by large companies in 1999 with the aim to improve Hungarian SMEs' innovative capabilities and competitiveness, promote their networking activities, especially those aimed at conducting technological development projects, and as a result of all these to help them becoming suppliers of large firms. Integration of local firms through value chains and FDI is policy which has been relatively undeveloped in catching up UNECE economies. Hungary and Czech Republic are the examples of countries which have developed elements of this policy which goes beyond marketing of country as production location. There has been more policy focuses on local industry – R&D linkages for which weak and dependent local firms may not have immediate demand. This explains their irrelevance to local firms and their innovation activities, which are, value chain driven.

The Czech programme of support to subcontractors aims to increase competitiveness of middle-sized Czech subcontractors. A pilot stage was conducted in 2000-2002 for subcontractors in electronics and in the second stage (2002-2004) the programme was ex-tended to other sectors: car components, medical technologies, aeronautics, pharmaceutical industry and biotechnologies. Business activities of interested companies are first assessed on the basis of European Foundation for Quality Excellence, areas to be improved are identified which are then developed through training, consultation, working meetings. Information on requirements as well as contacts to MNCs are provided to subcontractors.

In Azerbaijan, policy efforts have been focussed on strengthening the links between FDI in the oil and gas industry and local companies, in collaboration with multilateral financing institutions. These SME linkage programs aim to improve the capacity of local companies in the oil and gas service support sector to work with foreign partners. Participants in the programme benefit from targeted advisory services, improved access to finance and the creation of local business development services providers. Similar initiatives have also been developed in Kazakhstan, where a vigorous local content policy has been a central plank of the strategy to develop a local industry on the wake of massive FDI in the oil and gas sector. However, the somewhat rigid rules create scope for rent-seeking; other initiatives, focussing on the upgrade of skills or the development o joint ventures, appear to be more promising.[128]

Clusters; regional approaches and policy measures

Proximity was no asset under socialism and, hence, productivity improvements which could accrue through localized collective technology activities were virtually non-existent. The tendency towards regional horizontal and vertical integration was limited. Support and development of business networks is thus a new policy concept in the catching up UNECE economies. Inter-firm cooperation is encouraged mainly through traditional business intermediaries (federations, associations etc.). More recently, clusters have also started to emerge. Clusters are geographic concentrations of interconnected firms and associated institutions in a particular field. The interconnectedness takes place through skilled people that move between firms, regular exchange of market information and partnerships around specific projects. The assumption is that clustered firms enjoy positive externalities which enable them to increase the productivity more then non-clustered firms.

Box C.3.5 Country experiences: Policies to support clusters

The Hungarian automotive cluster[129]

'PANAC, founded in 2000 and supported by the Ministry of Economics, is a pilot cluster project located in the Györ region in Hungary, and now having 67 members in a cooperative network. Most of the automotive companies present in Hungary participate in it: Audi Hungaria, Opel Hungary, Hungarian

[128] World Bank (2005), "Kazakhstan. Country Economic Memorandum", Washington D.C.: The World Bank.

[129] ibid.

Suzuki, LuK Savaria Ltd. The cooperative activities include assessment of automotive requirements for suppliers, exchange of know-how and expertise, and partnerships with universities. PANAC is developing a coordination role in the automotive industry, which is one of the most important sectors in the Hungarian economy. This experience suggests that through the cluster, foreign investors diversify their local activity while on the other hand also attracting increasing numbers of firms with related businesses. The emergence of the cluster was made possible by the use of advanced information technologies, which contributed considerably to decreasing the costs of communication, monitoring and transaction. In addition, Hungarian firms could become suppliers of large multi-national companies not only in the automotive industry but also in IT-related services.

The Slovenian Transport Logistics Cluster[130]

In the late 1990s, the Slovenian government started an effort of clusters building and support, and in 2001 the first generation of clusters was launched, including the Transport Logistics Cluster (TLC). It has the mission to provide joint education programmes, market and competition analyses, market presence, equipment procurement and integral development of services. The cluster members seek to offer integrates transport-logistics services along the Slovenian corridor as the south gateway for markets in Central and South-eastern Europe. The TLC cluster is constituted by a mix of companies and academic institutions, including transport companies, shipping agents, port reloading companies, companies dealing with environmental problems, institutions of higher learning and research (altogether employing more than 13,000 people). It is backed by strong ICT support and applications including e-work applications (e-Portal and e-Stock-Exchange of logistic services) and integrated information support systems.

Two Polish clusters in the making[131]

Poland does not have programme of support to clusters at the national level but instead, it has 16 regional programmes that encourage cluster creation. So far, two clusters are emerging as a result of bottom up initiatives. The Polish aviation cluster in the south-eastern region of Podkarpackie associates 40 companies and the Rzeszow University of Technology. The Podkarpackie region has 100 years of aviation industry history, and thanks to that attracted the United Technologies Corporation from the US to invest in the local aircraft engine producer WSK PZL Rzeszów, taking the lead in building the Aviation Valley cluster. Cluster members are now producing parts for the aviation industry worldwide, including Airbus in Europe, and the cluster now numbers 50 companies. The second cluster is the furniture cluster in region Wielkopolska which covers all aspects of the supply chain, from specialised research facilities like the Institute for Wood Technology in Poznan and the Institute of Natural Fibres, through subcontractors such as paint and chemical suppliers, to the furniture manufacturers themselves – in all covering 3,700 businesses. Furniture manufacturers took the initiative to form the cluster in co-operation with Poznan University of Economy. An evaluation of this cluster[132] indicated that the companies are still reluctant to enter into co-operative relationships, especially with competitors, and they also do not see the benefits accruing from co-operation with rivals. This experience highlights the importance of the social and cultural context, and the need for dedicated efforts to overcome some of the related difficulties.

No explicit cluster policy measures have been applied in Slovakia so far. Rather, national-wide polices were adopted in particular policy areas (such as entrepreneurship and SME policy, sectoral industry policy, S&T and regional policies etc.). These are non-discriminative and do not target specific regions and/or industries (with the exception of the car industry). The development of clusters was added to 'wish lists' of some innovation policy measures. These, however, supported establishment of industrial

[130] Hans Schaffers, Rimantas Gatautis, Heli Penttinen, Andrea Szalavetz, and Peter Tancig (2006), "Emerging Value Clusters in the New Member States: The Role of Collaborative Innovation", Summary of project, mimeo.

[131] From the e-article: "Different Approaches to Cluster Support", *European Innovation*, 2/07 (available at http://cordis.europa.eu/aoi/article.cfm?article=1827&lang=EN).

[132] Marian Gorynia, Barbara Jankowska and Radoslaw Owczarzak (2007), "Clusters – an Attempt to Respond to the Globalization Challenge? The case of Poland", Paper presented at the Seventh International Conference on 'Enterprise in Transition', Bol - Split, 24 - 26 May 2007.

parks rather than creation of specific clusters. The development of clusters in Slovakia rather followed the logic of market forces, economic geography and flows of the FDI, than any formal cluster policies.[133]

It is estimated that in the EU, every fourth company employing at least 20 persons (or 24 per cent of the total) 'works in a cluster-like environment characterised by close cooperation with other local businesses and strong ties to local business infrastructure'.[134] However, the difference with NMSs in terms of clustering is striking: in 2004, the proportion of companies working in a cluster-like environment was only 9 per cent in the NMSs, compared to 28 per cent in the EU-15 countries.[135] A significantly weaker clustering contrasts sharply with an unrealized potential for clustering: 367 regions in the NMSs with 5.86 million employees meet at least one criterion for developing a cluster potential (absolute size, specialization or regional importance).[136] It is only recently that programmes for supporting clusters have become policy tool in some countries, for example, in the Czech Republic, Hungary, Lithuania, Poland, Romania, Slovenia (see Box C.3.5). There is a great need for cluster facilitators who could work in regions and raise cluster awareness and improve the culture of cooperation among entrepreneurs.

However, the attempts to construct regions or local clusters as environments where innovation would flourish are faced with obstacles. The level of clustering development in the catching up economies is still low. However weak the national innovation systems, they still dominate over regional systems, which suffer from inadequate, or absent systems of governance, weak competencies and resources at the regional level.

More generally, in an increasingly globalised economy, regions are perceived as sources of competitive advantage.[137] This has led to the emergence of a regional innovation policy or development of regional approach (component) to national innovation policy. In the majority of the OECD countries, regional agencies and funds have been established for its implementation. Also, there is a trend of establishing mechanisms for the coordination of innovation policy between the national level and regions (e.g. joint committees, a national strategy process incorporating regional authorities, etc.).

For the UNECE catching up economies, regional innovation policy is a very recent activity. Historically in these countries, local (horizontal) networks were absent and there was a lack of regional autonomy. In general, the importance of regions and regional policy in most of the catching up economies has been low, with the partial exception of Poland. During the 1990s, there was a trend towards fragmentation of regional governance into municipalities and communes in the NMSs which was followed by re-concentration of power into national governments. With EU accession, Europeanised regionalization has been pursued 'from above', to meet the EU conditionalities. Its main aim has been to enhance the 'regional capacity' for absorption of structural funds. The need for extensive decentralization may be

[133] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Slovakia, 2007* (draft).

[134] Innobarometer (2006), "Innobarometer on Clusters' Role in Facilitating Innovation in Europe: Analytical Report", July 2006, Flash Eurobarometer 187 – The Gallup Organization, European Commission.

[135] Ibid.

[136] Christian Ketels and Örjan Sölvell (2006), "Clusters in the EU-10 New Member Countries", Study commissioned by EU DG Enterprise, Europe Innova.

[137] Michael Porter (1990), *The Competitive Advantage of Nations*, New York: The Free Press.

necessary only in the two largest NMSs, Poland and Romania. An increasing focus on regions is pursued by reallocating funds from restructuring in sectors like coal-mining, railway and ship-building, or for their preservation towards regional aid. A focus on regions is often linked to incentives to Special Economic Zones (SEZ). Recently, an increasingly significant role has been played by regional aid awarded to entrepreneurs within the framework of operational programmes co-financed from EU funds.

The dispersion of regional funds may not necessarily bring regions closer to the EU level, especially where structural funds will be overseen by the national government. So the key challenge is to undertake a shift from regionalization as an administrative task to the development of regional governance. A step towards this is regional innovation strategies as ways to identify problems related to cooperation between RTD organizations and enterprises. However, strategies do not solve of further implementation and specific projects.

Links between Research and Technology Organizations (RTOs) and industry

Historically, the function of supporting diffusion of new knowledge through the economy in the UNECE catching up economies has been conducted by the so called 'industry institutes' which used to serve several enterprises or entire industrial branches. Some catching up economies have still retained an extremely high number of branch R&D units as compared to developed market economies (for example, Russia, Poland, Romania, Ukraine, among others). These types of organizations are important for catching up as they could in principle form the core of networks of RTOs and technical services. However, so far they have not yet developed into public or private organizations that would serve the needs of SMEs. Only few units became the vehicle of modernization of local industries.[138] The majority of these organizations have been exposed to passive adjustment which led to severe down-sizing and short-term 'technical service' focus of activity (see Box C.3.6).

At the same time, new networks of innovation support centres have emerged. For example, in Poland in 2004, there were 537 centres dealing with support for innovation. Although since 2000 their number has almost doubled, still over half of these centres (55 per cent) offers mainly training, counselling and information services. Only one out of ten innovation centres was able to support the innovative activities of enterprises by means of technology transfer.[139] In other words, these new networks mainly serve as centres of generic information provision and have weak technology and industry specific capabilities.

Box C.3.6 Country experiences: Supporting the links between RTOs and industry

The Swedish program of joint competence centres programme represents an example of good practice in this area.[140] The programme, which involves 28 centres, started up in 1995, with the intention to operate up to 10 years. The programme approach was inspired by foreign models, in particular, the US National Science Foundation's Engineering Research Centres, and has clearly meant a renewal of the Swedish

[138] Jan Kozlowski (2003), "Governmental Research Units in Poland: Present, Future and the Burden of the Past", Warsaw, mimeo.

[139] OECD (2006), "Peer Review of the Policy Mix For Innovation in Poland", Draft of the Country Background Report, *Poland, Case of the Catching up Country*. Paris: OECD.

[140] Vinnova (2004), "Impacts of the Swedish Competence Centres Programme 1995-2003", Summary report by Erik Arnold, John Clark, Sophie Bussillet, Technopolis Ltd.

RTDI system. The evaluation of programme offers very positive conclusions about the competence centres as instruments of innovation and research policy in Sweden:
• Firms have generally been willing to maintain their inputs to Centres, and the programme has attracted a growing number of industrial participants;
• The centres have built strong interdisciplinary research environments at the universities, making major contributions to postgraduate education, developing the new styles of leadership needed to build research-based relationships and universities' research programmes;
• Repeated international peer reviews indicate that most of the centres have become high-quality, internationally viable research groups.

The competence centres programme helps in training useful people, producing large networks and improving the way members work together on R&D questions. It also helps in triggering a change in university-industry relations needed to build a real 'knowledge society' and strengthening the knowledge communities that are core to innovation systems. There has been a tendency for work to become increasingly 'near-market' over time, in response to the need for centres to develop a life cycle that will enable some of their activities to survive the end of their ten-year funding. VINNOVA and the Swedish Energy Agency need periodically to launch new centres into such life cycles, so that the portfolio of competence centres constantly adapts to national needs and scientific and technological opportunities. The competence centres have been imitated in Austria, and have provided a strong design influence on new programmes elsewhere.

In a similar vein, Poland has established a set of network supporting institutions and agencies supporting the links between RTOs and industry, such as:[141]
· Governmental institutions supporting innovation and technology transfer: the Polish Agency for Enterprise Development; the Industrial Development Agency, Centres of Advanced Technologies, National and International Contact Points or other advisory bodies;
· Organizations and agencies for regional development and promotion (such as the Regional Industrial Parks created by Industrial Development Agency), science and technology parks, technology incubators, technology accelerators, centers of technology transfer and centers of excellences, clusters;
· Other business supporting institutions involved in generating and promoting innovation in economy (financial, advisory, information, insurance, legal) and their networks.

The Estonian 'Competence Centres Programme' has as its objective the raising of firms' competitiveness through strategic cooperation between the science and industry sectors. Competence centres are small R&D institutions established and operated together by number of companies and universities. The main characteristic of such centres is strong focus on applied research, which is needed for the product development of the founders of these centres. In a longer perspective, the centres should concentrate on industrial research, which must encompass over 50 per cent of their total R&D activities. The share of public funding for a competence centre is determined by the type of R&D activity and by the type beneficiary. Total budget of the program for 2005-2008 is 100 million EEK (6.391 million EUR). Private co-funding is depending of the type of activities. The first call for Competence Centre proposals was announced in February 2003. As a result of the competition in February 2004 contracts were concluded with 5 centres.

The Greek scheme 'Research and Technological Consortia in Sectors of National Priority' aims to foster the collaboration between business and research organisations through long-term research and technological development A number of sectors were targeted for this measure, which was expected to achieve significant demonstration effects, including energy, environment, agriculture and a number of knowledge-intensive activities. The public contribution to the projects, which are selected by peer-review, range between 50-70 per cent of total costs. This national plans has been complemented by regional efforts, as the initiatives has been integrated in regional operational plans that have contributed additional resources and extended it to other sectors.

The First Enterprise Scheme in Belgium (Wallonia) provides support for hiring young researchers, who carry out research relevant for the hiring company while continued to work part-time in an accredited research centre. This sharing of time is expected to facilitate technology and knowledge transfer to the

[141] Ibid

business sector while facilitating a better understanding of the needs and objectives of research and industrial partners.

The "mega projects" programme in Russia was launched in 2003 with the aim to increase the efficiency of public R&D spending through the involvement of the private industry in the different stages of large innovation projects, including selection, financing and implementation. For each project, a complete cycle is envisaged, covering applied research, development and marketing. Russia has also been active in the development of networks supporting the relations between research institutions and industry.[142]

The Republican Centre for Technology Transfer (RCTT) in Belarus[143] has as its primary goal the improvement of the infrastructure for support of innovation activity and technology transfer in order to boost the development of innovative enterprises, intensify the cooperation between developers, users of knowledge-based technologies and potential investors, promote the international partnerships in this field. To achieve this objective, it provides assistance to innovation activity agents in development and promotion of their innovation and investment projects, engages in the training of specialists in science- and innovation-related business activity and performs other related functions.

In Moldova, the 'Business Partnership Program' (BPP), promotes research and development (R&D) partnerships between companies and teams of scientists to develop new commercial opportunities of economic benefit to both parties. BPP projects must have R&D as their core task and must include a preliminary market assessment, customer needs analysis and business development components. Projects that demonstrate their ability to enable revenue creation and/or attract other sources of funding are to be assigned priority consideration in the selection process. All goals and outcomes of the projects must be defined and measurable.

An issue that is becoming important in the next stage of development of this infrastructure is the effectiveness of supporting organizations.[144] Sometimes supporting organizations like incubators serve as sites of subsided rents rather than as drivers of knowledge generation and diffusion. In other cases, they tend to operate as places of general support to business but not as the proclaimed places of innovation based growth.[145] In principle, such organizations should be demand-driven and should rely as much as possible on private sector expertise and skill. However, insufficient financial resources to perform their activities and, consequently, difficulties in hiring and preserving experienced staff, as well as operating on a project-to-project basis are disabling such a profile. As a result, in periods separating two projects, problems of these institutions aggravate further.[146]

The limits of linkage policies in catching up economies

The prevailing current conventional wisdom in innovation policy – very much based on the system of innovation thinking – is focused on the strengthening of linkages. From this logic, the focus in innovation policy should be placed on networking organizations like S&T parks,

[142] Science and Technology Russia (2006), *Critical Analysis and Topical Issues in Russia's Innovation System*, Science and Technology Commercialization Project (EuropeAid /115381/C/SV/RU) (available at http://topics.developmentgateway.org/).

[143] See http://ictt.by/.

[144] Itzhak Goldberg et al. (2006), "Public Financial Support for Commercial Innovation", ECSPF, Chief Economist's Regional Working Paper series, Vol. 1, No. 1, Europe and Central Asia, p.52.

[145] Slavo Radosevic and Marat Myrzahmet (2006), "Between Vision and Reality: Promoting Innovation Through Technoparks in Kazakhstan", *Economics Working Paper* No. 66, UCL School of Slavonic and East European Studies, (available at http://www.ssees.ac.uk/publications/working_papers/wp66.pdf).

[146] OECD (2006), "Peer Review of the Policy Mix For Innovation in Poland", Draft of the Country Background Report *Poland, Case of the Catching up Country.* Paris: OECD.

clustering, academy-industry links, etc. This logic assumes that the main problem lies in 'linkage/network failures' and implies that enterprises are fully-fledged business organizations endowed with all the necessary skills and capabilities, and if these are missing they can be either bought on the market or be developed via networking activities with other firms or with academic organizations.

Yet, an exclusive focus on linkages may neglect the fact that some of the actors and agents (in the first place, the enterprises, but also the universities and R&D organizations) may actually be the weak part of the chain. As already discussed in Chapter 2, in the case of the catching up UNECE economies local firms – with the possible exception of a top layer of few blue chip companies – are in fact weak actors, highly dependent on their foreign partners for access to market, technology and often to finance.

To some extent challenging this conventional mainstream approach, there is significant scope for direct diffusion oriented programmes in the catching up economies, especially in downstream activities related to production capability. Demonstration projects in areas like quality management, CAD/CAM systems, or business information systems in specific sectors are worth supporting due to their strong demonstration effects and learning potential. Such projects should be co-funded on the condition that the results of these demonstration projects are made available to other enterprises.

3.4 POLICIES TARGETING THE DEMAND FOR INNOVATION

The supply of R&D is only a part of the overall process of innovation that leads to a finished product being placed on the market or to higher competitiveness and economic growth at the national level. Unless there is demand for R&D and innovation economic recovery and growth will be not automatically followed by recovery of demand for domestic R&D and innovation. For example, growth in university education and ensuing increased supply of trained personnel may fail to create its own demand as its growth may not be connected to the growth of industry. Investment in domestic knowledge infrastructure will succeed only in the face of demand from users for the services provided by public R&D programs.

The macroeconomic equilibrium usually deals with the issues of the (mis-)match between market demand and supply for products at the aggregate level. However, demand and supply for products are not identical to demand and supply for technology, R&D and innovation. Technology is an intermediate input and output in the economic process and in an increasingly knowledge-intensive economy there is an increasing need to understand the determinants of technology demand.

The demand for innovation is shaped under the combined influence of various factors. Thus the overall macroeconomic and business environment represents the overall demand conditions for technology generation and diffusion. Macroeconomic stability and favourable framework conditions for business not only facilitate innovation but enhance overall economic performance. In emerging markets such as the catching up UNECE economies, a stable macroeconomic and business environment conducive to long-term investment in new activities is the best precondition for innovation-promotion policies.

The factors that influence the demand for technology at the macro and micro levels are numerous. The understanding of supply side factors of technology is relatively better than that of demand side factors. It is usually accepted that there are four broad components that

affect the demand for technology: macroeconomic framework, business environment, competition policy, and financial system. In addition, the demand for technology is determined specifically by the strength of the IPR regime and by public procurement.

Conducive macroeconomic framework

The development of innovative activities requires sound macroeconomic conditions. In the absence of such conditions, enterprises will focus on short-term gains and there is likely to be little investment in any activity that does not generate very rapid returns. However, macroeconomic stability by itself will not develop the country's technology potential.

When budgetary and monetary policy constraints are tight, this will lead – through budget pressures – to reduced R&D funding. On the other hand, when economic growth is high, this will not necessarily lead to changes in business expenditures on R&D, which may rather drift along the established historical pattern.[147] In order to reverse this trend, specific policy measures are needed to foster restructuring in business R&D expenditures. For example, the recovery and growth during the 1990s did not necessarily lead to increase in domestic real R&D expenditures in the catching up UNECE economies.[148]

In summary, the relationship between macroeconomic stability and innovation is not proportional in the sense that more stability would necessarily lead to more innovation and vice versa. This relationship is often nonlinear as confirmed by the link between the level of interest rates and economic growth. A decrease in inflation is stimulating up to a certain point below which its future increase may be counterproductive.

The link between technology policy and macroeconomic policy to achieve better coherence and co-ordination of policies to promote innovation is not well defined and sometimes poorly understood.[149] This separation may lead to contradictions of objectives, and probably in many cases to adverse outcomes.[150]

Business environment and competition policy

The investment climate and its dimensions like secure property rights, low barriers to market entry and a stable institutional environment are important in fostering innovation. A favourable investment climate extends the planning horizon and reduces the risk involved in innovative activities. The creation of new enterprises and restructuring of existing ones depends on the business environment.

---

[147] For analysis along these lines see Stanislaw Kubielas (2003), "Polish Macroeconomic and S&T policies: Interlinkages for Growth and Decline", *Journal of International Relations and Development*, Vol. 6, No. 2.

[148] Slavo Radosevic and Laudeline Auriol (1999), "Patterns of Restructuring in Research, Development and Innovation Activities in Central and Eastern European Countries: Analysis Based on S&T Indicators", *Research Policy*, Vol. 28, No. 4, pp. 351-376.

[149] See working papers from the MACROTEC project 'Integration of Macroeconomic and S&T Policies for Growth, Employment and Technology' at http://www.sussex.ac.uk/spru/1-4-4-1-3-1.html.

[150] For example, an important issue within this perspective is whether the EU Stability and Growth Pact would have to be relaxed if the EU is to come anywhere near achieving the Barcelona target of 3 per cent in R&D in GDP. Nick von Tunzelmann (2004), "Integrating Economic Policy and Technology Policy in the EU", *Revue d'Economie Industrielle*, Vol. 105, pp. 85-104.

Competition is an essential dimension of the business environment. Competition policy aims at preventing excessive market power and other distortions. In the absence of competitive pressures toward innovation, market shares may easily turn into market power and monopoly rents without benefits on growth. Usually, competition policy is designed on the basis of the assumed ability of competition to maximize static allocative efficiency. However, from innovation point of view, competition policy should be seen as a mechanism 'to foster economic progress through innovation, which could be understood, from an evolutionary perspective, as a kind of dynamic efficiency that could be called *selective* efficiency'.[151] In this case, the issue is to assess 'the extent to which a market, as a selective environment, induces the *evolution* along any innovative trajectory to be as close as possible to an objectively defined *progress* along such trajectory' (see also Box L.3.1).[152]

Box L.3.1 Lessons learned: Market competition and innovation

Most empirical research has found evidence of a positive correlation between innovation and competition.[153] However, recent research shows that this relationship is a somewhat more complex and that effect of competition depends on how far are firms from technology frontier.[154] Reduced barriers to entry to foreign products and firms have a more positive effect on economic performance for firms and industries that are initially closer to the technological frontier. In contrast, performance in firms and industries that are initially far from the frontier may actually be damaged by liberalization.[155] This polarising effect of liberalization has important effects on competition policy which has to take into account the technological level of local industry when assessing effects of competition on performance. In policy terms, this would require coordination between competition and industrial policy. In traditional static perspective, this would be interpreted as conflict between objectives of competition and industrial policy. However, in a new environment, the trade-offs between competition and industrial policy may be lower than traditionally assumed.

In summary, there are three main relations between competition and innovation. First, there can be a negative relation corresponding to the Schumpeterian argument of innovation being stimulated by some kind of monopoly power. Second, there may be a positive relation corresponding more to another Schumpeterian argument of innovative entry of new firms and associated with the idea to make markets operate more efficiently in both the static and dynamic sense. Third, there is a nonlinear, inverted U-shape relation between competition and innovation, in which competition stimulates innovation up to a certain point after which is becomes detrimental. Macroeconomic stability and the quality of the business environment are important ingredients of innovative performance. However, the degree of competition and trade openness is not linearly correlated with innovation. In principle, competition is essential to innovation but its effects will depend on distance of local firms form technology frontier. In addition, openness by itself will not guarantee better performance. From a policy perspective these issues call for a new innovation focused perspective on industrial and competition policies.

[151] Mario L. Possas and Heloisa L. Borges (2005), "Competition Policy and Industrial Development", Institute of Economics, Federal University of Rio de Janeiro (UFRJ), IPD Industrial Policy Task Force.

[152] Ibid.

[153] Christian Gianella and William Tompson (2007), "Stimulating Innovation in Russia: The Role of Institutions and Policies", *OECD Economics Department Working Papers*, No. 539, Paris: OECD.

[154] Philippe Aghion, Wendy Carlin, Mark Schaffer (2002), "Competition, Innovation and Growth in Transition: Exploring the Interactions between Policies", William Davidson Institute Working Paper No. 501; Wendy Carlin, Mark Schaffer and Paul A. Seabright (2004), "Minimum of Rivalry: Evidence from Transition Economies on the Importance of Competition for Innovation and Growth", *Contributions to Economic Analysis and Policy*, Vol. 3, No. 1, pp. 1-43.

[155] Philippe Aghion and Evguenia Bessonova (2006), "On Entry and Growth: Theory and Evidence", *Revue de L'OFCE*, pp. 259-278.

According to some authors,[156] the policy-institutions framework supportive of competition should be flexible and pragmatic, and should contain a creative destruction management – or the promotion and regulation of entrepreneurial success – as one of its main goals. In its competition policies dimension, it should be not anti-bigness but anti unproductive entrepreneurship, pro-efficiency but not libertarian and, especially, it should be pro-cooperation, leaving room for business networks to thrive and for state sponsored administrative guidance's initiatives. It should also engineer policies towards the development of multiple sources of experimentation and should allow room for industrial and technology policies without jeopardizing its own core theoretical assumptions. In its intellectual property dimension, it should not point to a 'one size fits all' institutional design and should not pursue the maximum protection of monopolistic rents, but to search for the minimal common denominator, allowing for institutional and technological diversity and distinctive developmental strategies.

In its broader definition, industrial policy should encompass competition policy as its part. As pointed out by some analysts, 'once a dynamic view of competition is assumed, in which competitiveness is related more to innovativeness of firms and to systemic pressures from the market environment than to the number of competitors and to static allocative efficiency effects, industrial and competition policies are more easily seen as complementary rather than as opposed to each other'.[157] In this dynamic perspective, some barriers may operate positively on R&D. For example, there is an unambiguous negative effect of non-tariff barriers and state control on R&D. However, trade tariffs as well barriers to entrepreneurship are positively associated with the R&D intensity. An OECD study [158] explains this relationship as being due to *ex post* innovation rents and improved appropriability conditions which enable the increase in R&D intensity.

Adequate financial system[159]

A well-developed financial system is an important aspect of a favourable environment for growth, especially in a period of the rapid spread of a new technology when they can promote new, innovative enterprises.[160] By reducing the costs of external financing the costs of new equipment are reduced which increases the opportunities for imitation and innovation.

A large majority of firms in the UNECE catching up economies rely on retained earnings to finance investment and innovation. According to innovation surveys, the shortage of own funds and the costs of innovation projects are the major barriers to innovation. An expansion of overall financial system in the catching up economies is largely oriented towards consumer credit markets and much less to corporate sector. A fast growth of banking sector in these economies has been essential to consumer demand driven growth during the early 2000s. However, this should not limit the positive role of the financial sector which should develop into an intermediary of innovation driven growth as well. In this respect, the financial sector

[156] Leonardo Burlamaqui (2006), "How Should Competition Policies and Intellectual Property Issues Interact in a Globalised World? A Schumpeterian Perspective", Tallinn University of Technology, Working Papers in Technology Governance and Economic Dynamics No. 6.

[157] Mario L. Possas and Heloisa L. Borges (2005), "Competition Policy and Industrial Development", Institute of Economics, Federal University of Rio de Janeiro (UFRJ), IPD Industrial Policy Task Force.

[158] OECD (2003) *The Sources of Economic Growth in OECD Countries*, Paris: OECD.

[159] The policy issues related to the financing of innovative development are dealt with in detail in another focus area of the UNECE Sub-programme on Economic Cooperation and Integration. Here these issues are just mentioned for the sake of the completeness of the overview.

[160] Ibid.

in majority of the catching up economies is not yet adequately oriented, that is, there is lack of incentives to mobilise funds for innovation, in particular for SMEs. In addition, the share of new capital raised on stock markets is still playing minor role in the overall finance of innovation. Capital markets themselves are still small, volatile and illiquid.

Intellectual Property Rights (IPR)[161]

As innovation has become crucial part of a catching-up strategy, the related R&D is not longer associated to world technology frontier only. In addition, differences among countries in terms of 'pure' technology competitiveness (patents) are becoming more and more important for explanation of growth differences.[162] This increases importance of patents and IPR policy in catching up. However, establishing an IPR regime which would balance its knowledge generation and knowledge diffusion function is not easy. There are competing demands on IPR system to meet and the final outcome is a compromise between demands for greater incentives to knowledge generation vs. diffusion. It is for certain that all knowledge based sectors like software, R&D and other knowledge intensive services are inhibited by weak IPR enforcement. In the IPR area two policy issues are of great importance for the catching up economies: the *assignment* of IPRs, particularly where R&D is financed from public sources, and *enforcement* of IPRs, particularly in assessing degree of 'inventive level'.

Fiscal Incentives

An increasing number of UNECE governments are offering special fiscal incentives to business to increase spending on research and development (R&D) and innovation. There are important differences between countries in the extent to which they rely on tax incentives as indirect instrument of stimulation of R&D demand and the extent to which they rely on direct subsidies or on their combination (see Box C.3.7). Tax incentives seem as a solution more compatible to market as they leave the choice of whether to conduct R&D in the hands of the firms. On the other hand, until recently the mainstream economic wisdom objected to fiscal incentives on the ground that their response elasticity is so low that it would take a huge tax change to generate the socially desirable level of spending. In addition, projects supported will be not necessarily those most needed from social point of view but those that are most profitable for firms. As an alternative, the state could do better by directly supporting the projects with the highest social benefits. However, faced with pervasive government failure, this may be an inefficient solution. Empirical research demonstrates mixed results when comparing the effectiveness of subsidies as compared to tax incentives. In both cases, there is the problem of assuring the additionality of government support, that is, avoiding the danger that the state may simply subsidise activities that would have been undertaken anyway.

Box C.3.7 Country experiences: Fiscal measures supporting R&D

[161] The policy issues related to the role of intellectual property rights in innovative development are dealt with in detail in another focus area of the UNECE Sub-programme on Economic Cooperation and Integration. Here these issues are just mentioned for the sake of the completeness of the overview.

[162] Bart Verspagen (2001), "Economic Growth and Technological Change: An Evolutionary Interpretation", STI Working Papers 2001/1, Paris: OECD.

In the last 20 years, the general trend towards lowering tax rates and broadening the tax base has been accompanied by more generous tax treatment of R&D.[163] The trend of increasing importance of R&D related fiscal measures continues. For example, a recent EC study concludes that R&D fiscal measures are more common in EU member states now than in 2000.[164] The number of EU member states implementing some of fiscal incentives for R&D has been rising continuously and now stands at 17 out of 27 member states. Moreover, the generosity of fiscal incentives has significantly increased since 2000. An accepted estimate is that tax incentives can increase private research spending by an amount equal to the loss in tax revenue on average,[165] that is, a dollar in tax credit for R&D stimulates a dollar of additional R&D.[166] Most measures supporting R&D expenditures do it through some type of tax allowance (i.e. these expenditures can be deducted from taxable income). The Dutch fiscal provisions for R&D support include a facility that lowers wage costs for R&D employees by reducing tax and social security contributions for companies. In the UK, the R&D tax credit schemes aims to improve the incentives for companies to carry out R%D activities. The relevant provisions have been modified as a result on extensive consultations with the business community, which resulted, among other changes, in including also the hiring of external staff on schemes covering expenditure on costs.

Recently there has been a proliferation of tax incentives for R&D in NMSs as well together with the trend of reducing tax rates. However, in some EU countries, both old and new (the Czech Republic, Cyprus, Germany, Slovakia and Slovenia) there are no fiscal measures to support research. Hungary stands out for the number and comprehensiveness of fiscal measures targeting R&D, which include not only tax allowances and credits but also tax deferrals. Tax allowances are particularly generous for company labs located at university or public research institutes. SMEs benefit from a special IPR allowance to cover the costs of obtaining and maintaining patents, if these expenditures cannot be considered part of R&D outlays. Comparative surveys at the EU level also suggest that in many countries, the indirect cost of tax expenditures (as opposed to direct outlays) is poorly understood. While there are clear benefits in the use of fiscal measures (involvement of the private sector, ease to administer, transparency), there also obvoius limits to its effectiveness. In particular, fiscal measures are less appropriate to encourage fundamental research and cash-constrained early stage activities.[167]

In the United States, the Economic Recovery and Tax Act of 1981 (ERTA) provides for, among other things, a tax credit for increases in research and experimentation (R&E)/spending above a determined base level.[168] In Israel, there are several specific tax concessions related to R&D and innovation.[169] Thus expenditure on R&D projects approved by the Ministry of Industry, Trade and Labor (MOIT) can be treated as direct deductible expenses rather than as investments. Tax incentives are also offered to (1) any investor in a R&D program who is not a shareholder in the company; (2) any enterprise owner who is doing research for the enterprises' development; and (3) any scientific employee/worker who works during a sabbatical year, whereby incentives are given relative/proportional to salary. Among the EECCAs, Russia supports R&D through the tax exemption of R&D expenses. Also, there is VAT tax break for "research organizations".[170] Among South Eastern European countries, Croatia R&D

[163] Bronwyn Hall and John Van Reenen (2000), "How Effective are Fiscal Incentives for R&D? A Review of the Evidence", *Research Policy*, Vol. 29, No. 4-5, pp. 449–469.

[164] EC (2007), *Green Paper 'The European Research Area: New Perspectives'*, p.23.

[165] OECD (2004), *Tax Incentives for Research and Development: Trends and Issues*, STI - Science Technology Industry, Paris: OECD

[166] Bronwyn Hall and John Van Reenen (2000), op. cit.

[167] Expert Group on Fiscal Measures for Research (2004), *Report Submitted to CREST*, The Hague, 2004.

[168] Albert N. Link (2007), "U.S. Innovation and Competitiveness Initiatives. White Paper prepared for the UNECE Team of Specialists on Innovation and Competitiveness Policies", University of North Carolina at Greensboro, Department of Economics, June 10, 2007.

[169] Daphne Getz and Vered Segal (2007), "Creating a Conducive Environment for Higher Competitiveness and Effective National Innovation Systems. Israel", Report submitted to the UNECE, mimeo.

[170] Christian Gianella and William Tompson (2007), "Stimulating Innovation in Russia: The Role of Institutions and Policies", *OECD Economics Department Working Papers*, No. 539, Paris: OECD

expenditures can be deducted from the tax base since 2003[171], but the fiscal treatment has been recently hardened.[172]

An OECD review of tax incentives concludes that the effectiveness of fiscal incentives to R&D depends very much on the design of tax measures relative to policy objectives. [173] In principle, fiscal incentives should target R&D activities, and not support specific sectors or groups of enterprises. There is a scope for UNECE countries to learn from each other in this respect especially in terms of administrative requirements, forms of incentives, target groups, definition of R&D activities, treatment of foreign firms, etc.

Public procurement

Public procurement has been historically a very important instrument of technology development in developed and catching up economies. In the case of public technology procurement (PTP), a public agency places a contract to a firm ordering the development of a technology or an artefact which did not exist at the time of granting the contract but which the partners believed could be developed.[174] This mechanism works from the demand side as the functions of a product or system are first specified buy the procurer. This requires innovation which means that PTP 'pulls' innovation by articulating a proto-demand.[175] In addition, PTP usually involves a close interaction between the procurer (user) and the producer. The study of innovative procurement in EU shows that there are no single best practices in terms of organization or models[176]. The crucial issues are intelligence gathering, risk sharing and training to create intelligent customers.

Regulations as stimulus of environmental innovation

Environmental policies seldom explicitly target innovation processes. However, with climate change and demands for sustainable development there are increasing pressures to stimulate environmental innovation. The most important external drivers of environmental innovation are regulations and market related drivers, such as competition and the prospects of increased market shares. However, government demands remain a very important driver of environmental innovation. The empirical results seem to show that most instruments have only had limited effects on innovation. However, there is increasing belief that industrial innovations may contribute to shifting society towards sustainable development. For this to

[171] Vjekoslav Bratić and Ivica Urban (2006), "Tax Expenditures in Croatia", *Financial Theory and Practice* (Croatia), Vol. 30, No. 2, pp. 129-195.

[172] Sandra Švaljek (2007), "Tax and Legal Environment for the Private Equity and Venture Capital Industry in Croatia", Presentation to the Centre for Policy Development on Small and Medium Enterprises, July 2007.

[173] OECD (2004), *Tax Incentives for Research and Development: Trends and Issues*, OECD, STI - Science Technology Industry, Paris: OECD.

[174] Charles Edquist, Leif Hommen and Lena Tsipouri (eds.) (2000), *Public Technology Procurement: Theory, Evidence and Policy*, Boston/Dordrecht/London: Kluwer Academic Publishers.

[175] Charles Edquist (2002), "Public Technology Procurement as an Example of Public-Private Partnership", Memo written for the Expert Group on 'Improving the Effectiveness of Direct Support Measures (Direct Measures) to Stimulate Private Investment in Research', mimeo.

[176] Based on: EU (2006), "Innovation and Public Procurement. Review of Issues at Stake", Study contracted by Fraunhofer Institute for Systems and Innovation Research.

happen there is a need for improved environmental policy as well as environmentally motivated innovation policy (See Box L.3.2).

Box L.3.2: Lessons learned: Could external demands drive environmental innovation in firms ?

A recent VINNOVA study has come up with a series of policy relevant conclusions regarding environmentally motivated innovation policy:[177]

• *Both sustainability and growth require increased cooperation between the areas of innovation and environmental policy*

Increased attention to innovation issues may increase effectiveness in addressing environmental problems. There is a shift going on from regulation as the main driver of environmental innovations to a situation where both regulation and market forces drive. The strategies of firms broaden from regulation compliance and cost reduction to the exploitation of the profit potentials that lies in environmental innovativeness. This implies that increased attention should be given to environmental innovation within innovation policy both to increase growth and to reduce the impact on the environment.

• *Policies should target value chains and networks, especially to involve SMEs*

The systemic interdependencies of a firm's innovation processes may contribute to explain why small firms experience, to a lesser extent, environmental demands. Environmental demands from customer firms may be mixed with, and translated into, other demands, thereby creating an environmental pressure that is not experienced as such by the supplier. It may also be the case that environmental issues are important to customer firms, even if they have not begun to make environmental demands on their suppliers. Supplier firms need to be aware of the strategic importance of such unexpressed interests. This implies that policies should target value chains and networks rather than individual firms.

• *There is a choice to be made between quick results and large results*

Increased investment in already available technology may bear fruition sooner than new technology, which requires time consuming development work and at times lengthy research. It is important to give more attention to the time span involved in developing technology and new products when designing policy

• *Policy instruments should be used in a coordinated manner for best effect*

Since there is no single best instrument, with instruments have differing strengths and weaknesses, and influence one another, policy makers should give ample attention to the problems and possibilities of simultaneous and coordinated use of more than one instrument.

• *Regulation stimulates innovation. Apart from that we do not know, yet.*

Regulations that cannot be met with available technology, but where appropriate technology can be developed at a reasonable cost and in the not too distant future, can stimulate radical innovations. Such regulations may however impose high costs on the regulated firms.

[177] Nils Markusson (2001), "Drivers of Environmental Innovation", VINNOVA Innovation i fokus VF 2001:1.

CHAPTER 4. POLICY IMPLEMENTATION AND EVALUATION. LEARNING FROM GOOD PRACTICES

4.1 INNOVATION GOVERNANCE

The governance structure of the national innovation system represents the concerted efforts at many levels in many different organizations, including interfaces with the business sector and society at large, which together generate integrated innovation policy.[178] The multidimensional and multisectoral nature of innovation activities calls for integration or collaboration of a large number of different policy areas: economic, financial, industrial, education and science, employment, regional, social and health, and environmental policies (see Box C.4.1).

The importance of innovation governance has increased due to several inter-related factors.[179] First, the increasing relevance of S&T to economic growth, environmental performance and public health increases the need of involving the public at large in the governance of R&D. Second, the continuing spread of the so-called New Public Management provides a more general impetus towards transparency and efficiency in innovation and research policy as elsewhere.[180] Third, the increasingly systemic nature of innovation implies a need to bring together different types of knowledge and knowledge producers, both across disciplines and between fundamental and applied work.

Governance mechanisms and structures

Similar to the different NIS concepts, one can distinguish between two views on innovation governance: broad and narrow. The *broader* view refers to the capacity of a country to coordinate a large number of explicit and implicit policy measures that affect the innovation process. From this perspective, the question is how the broader governance system is organized to facilitate interaction and co-ordination of different dimensions of the innovation capacity. The *narrow* view deals with the capacity of public services (ministries, agencies, etc.) to manage the cycle of policy development and implementation. From this perspective, the question is how well equipped (with financial, intellectual and other resources) these agencies are to manage the policy cycle.

From the national innovation capacity perspective, the policy challenge is to combine the efforts for knowledge creation, diffusion and use in different areas, basically targeting national competitiveness and economic growth. Ideally, the coordination and integration of policy objectives and instruments in each domain should build upon and reinforce each other.

---

[178] OECD (2002), *Dynamising National Innovation Systems*, Paris: OECD.

[179] Erik Arnold, Patries Boekholt, Enrico Deiaco, Shonie McKibbin, John de la Mothe, Paul Simmonds, James Stroya, Rapela Zaman (2003), "Research and Innovation Governance in Eight Countries, A Meta-Analysis of Work Funded by EZ (Netherlands) and RCN (Norway)", Technopolis.

[180] New Public Management denotes the wave of public sector reforms throughout the world since the 1980s that seek to enhance the efficiency of the public sector. This approach is based on the assumption that more market orientation in the public sector will lead to greater cost-efficiency for governments, without having negative side effects on other objectives and considerations. For further information see http://en.wikipedia.org/wiki/New_Public_Management.

However, the obstacles to this are not trivial. According to an OECD study, the typical issues that arise are: [181]

- Lack of understanding of innovation policy in other policy domains undermines communication in the co-ordination process;
- Strong traditions, in particular in the science policy domain, create segmented 'belief systems';
- Different 'schools of thought', e.g. between neo-classical economics and innovation research, may block integration of innovation and economic policy;
- Dynamic coupling of problems, policy proposals and politics often takes place in the context of specific windows of opportunity;
- Specific sectoral policies may be framed in ways that define others as rivals. In addition, innovation policy may be seen as conflicting to sustainable development, transport policy, health-care policy or not engaging technology users;
- Strong political leadership is necessary to create a common vision and a legitimate basis for joint agendas.

There is a diversity of ways of managing innovation policy. A simplified typology of governance structures of the EU-25 illustrates well this diversity. According to an EC report, there are 3 major types of innovation governance in Europe:[182]

- Innovation is organized as a transversal component of public policy, where coordination streamlines initiatives of individual ministries services:
  - examples include Ireland, Finland, Sweden, and Denmark.
- A more traditional approach:
  - a distinct role for research/education ministries viewing innovation as expected output of the RTD process and economy/industry ministries viewing innovation as a tool for encouraging investment and modernising SMEs;
  - examples include southern countries, such as Italy and Spain, but also the NMSs.
- Additionally, some 'special cases' which do not entirely conform to the above categorizations:
  - examples include UK, French and Greek systems, more federal approaches adopted by Belgium and Switzerland, and very small countries.

Innovation governance in Israel can be considered as a special case of good practice in the management of innovation policy (Box C.4.1).

Box C.4.1 Country experiences: Innovation governance in Israel[183]

The civilian R&D system in Israel comprises three components: government R&D, academic R&D, and industrial R&D. The government R&D is managed, budgeted and directed by the government through the chief scientists at the various government ministries. The academic and industrial R&D are independent in their R&D activities, although they receive some guidance from the government through its budgetary assistance. The main government bodies in charge of civilian innovation policy are the Ministries of Industry, Trade & Labor (MOIT), the Ministry of Science & Technology (MOST), the

[181] OECD (2005), *Governance of Innovation Systems, Vol. 1: Synthesis Report*, Paris: OECD.

[182] Trendchart (2004), *Innovation Policy in Europe 2004.* EC DG Enterprise and Industry.

[183] Daphne Getz and Vered Segal (2007), "Creating a Conducive Environment for Higher Competitiveness and Effective National Innovation Systems. Israel", Report submitted to the UNECE, mimeo.

National Council for Research and Development (MOLMOP) headed by the MOST, and the Council of Higher Education headed by the Minister of Education, as well as other government bodies.

The Office of the Chief Scientist (OCS) within the MOIT is responsible for carrying out government policy concerning support for industrial R&D. The role of the OCS is to assist in the development of new technologies, as a means of fostering the economy, encouraging technological entrepreneurship, leveraging the country's science-skilled resources, supporting high added value R&D, enhancing the knowledge base of high-tech industries and promoting cooperation in R&D, both nationally and internationally. MOST is responsible for forming a national policy oriented towards science and technology, technological analysis and organization, and for coordinating government research activities to ensure R&D within the Ministry's areas of responsibility. MOST aims to develop new technologies that will lead to new generation products – industrial, agricultural, medical and environmental products that replace older generation products. This objective is achieved through guided practical research. The ministry is also in charge of all budgets aimed at developing scientific and technological infrastructure, and is able to mobilize funds within government R&D. The MOLMOP was established on the basis of the 2002 National Council for Civilian Research and Development Act. The council includes 15 members, chosen by the government for a four year term and is headed by the Minister of Science and Technology. Its main tasks include advising the government on scientific issues of national importance, particularly those concerning the national scientific infrastructure; scientific guidance for the MOST activities, particularly with regard to the selection of priority research areas; provision of a forum for information exchange; and coordination of the R&D policy of various government and public bodies responsible for promoting R&D. The Council for Higher Education is the state institution responsible for higher education, including teaching and research. The Council is headed by the Minister of Education, and is a recognized statutory body for all matters pertaining to obligations, rights, and legal action. The Planning and Budgeting Committee (PBC) is the Council's executive arm and was established by a government decision. The PBC has exclusive authority for disbursing the global authorized budgets to the various institutions of higher education.

Policy coordination and coherence of innovation promotion

Innovation is an inter-sectoral activity with numerous direct and indirect effects and linkages. The potential technology spillovers from one sector to another as well as the interactions between technology developers, their 'suppliers' (such as universities, R&D institutes, etc.) and their 'customers' (such as downstream firms that utilise the innovations in question) represent a complex web of interactions whose complexity can be only partly grasped let alone managed. However, good innovation governance aims to ensure at least some basic vertical and horizontal policy coordination of major innovation actors, both public and private. In a nutshell, it is important to assess whether the governance system enhances learning by interacting among different components of the NIC and sub-systems of the NIS. For example, technology users should be engaged in policy processes in order to take into account new applications of emerging technologies. The issue at stake is whether innovation governance facilitates and enhances vertical coordination between these 'suppliers' and 'users'. Another vertical policy issue is whether there are interconnections between the different phases of the policy process, from policy conception (such as agenda-setting and prioritization) to implementation, to evaluation**.** An example of the horizontal coordination issue is the gap between R&D and innovation policy. In general terms, the issue is whether innovation governance, that is, the processes of decision-making actively assist 'learning by interacting', especially with regard to applications of emerging technologies. This is one of the most basic functions that are expected to be performed by the systems of innovation (see Box C.4.2).[184]

[184] Marko P. Hekkert, Roald Suurs, Simona Negro, Stefan Kuhlmann, and Ruud Smits (2007), "Functions of Innovation Systems: A New Approach for Analysing Technological Change", *Technological Forecasting & Social Change*, 74(4), pp. 413–432; Anna Johnson (2001), "Functions in Innovation System Approaches", Paper presented at DRUID conference 2001, Danish Association for Research on Industrial Dynamics, Copenhagen.

From the perspective of the innovation system, the poor connectedness within the NIS is often seen as a key policy issue.[185] The systemic policy view is embodied in the *functional* innovation system view, which focuses on how different functions in the innovation system are developed and connected, and whether their interaction generates robust innovation outcomes.[186] This view leads to systemic policies aimed at providing remedies to the poor functionality of the innovation systems by strengthening incentive mechanisms and removing blocking mechanisms. However, this policy approach is also the most demanding in terms of the knowledge required for policy analysis, and the understanding of key bottlenecks in innovation systems. In this respect, its application is likely to be limited, and confined to sectoral systems of innovation.

Innovation promotion is a multi-level governance activity in the sense that it is affected by decision making bodies at the sectoral, regional, national and global levels. This is difficult to ensure without some degree of coherence but also plurality and contestability in public decision making. In this respect, there is a need for a long-term vision about technological and economic development. The main purpose of this long-term vision is to ensure the coherence of the related actions by public bodies and private actors. Hence, one important element in assessing innovation governance is to make sure that it incorporates an institutionalised process of generating long-term visions (foresight) of the technological and economic development.

Box C.4.2 Country experiences: Policy coordination

Denmark undertook in 2002 a policy reform primarily aimed at better policy coordination.[187] The public part of the national Danish research and innovation system was traditionally considered as too fragmented and uncoordinated. However, in July 2000, a Danish Research Commission was established to review the relevant legislation with a view to enhancing the efficiency of the entire research system. The results of this appraisal were presented in September 2001. Based on the Commission's recommendations, the Parliament and the government embarked on a reform of the entire public research and innovation system in 2002, when a new Act on Technology and Innovation was passed. As a consequence, the Danish innovation system has been restructured considerably in the last few years. To strengthen the coordination, responsibility for both research and innovation was for the first time assigned to a single ministry. Innovation related policies and measures were transferred from the Ministry of Economic and Business Affairs to the new Ministry of Science, Technology and Innovation. At the same time, some of the competences of the former Ministry of Trade and Industry regarding trade and business services and innovation related policies were placed with the Ministry of Science, Technology and Innovation. Similarly, the administration of the university sector was transferred from the Ministry of Education to the new ministry. In effect, this reorganization moved practically all innovation related policies within the purview of the Ministry of Science, Technology and Innovation. Furthermore, a new body, the Council for Technology and Innovation, was set up to assist in the implementation of the new legislation. The council advises the Minister of Technology, Science and

[185] For an elaboration of this view in the context of the EU see CEC (2004), *European Economy. No 6*. Office for Official Publications of the EC. Luxembourg. KC-AR-03-006-EN-C, ch. 6.

[186] Anna Bergek, Staffan Jacobsson, Bo Carlsson, Sven Lindmarki and Annika Rickne (2005), "Analyzing the Dynamics and Functionality of Sectoral Innovation Systems – A Manual", Paper presented at the DRUID Tenth Anniversary Summer Conference 2005 on Dynamics of Industry and Innovation: 'Organizations, Networks And Systems', Copenhagen, 27-29 June 2005; Bo Carlsson, Staffan Jacobsson, Anna Bergek (2004), "Dynamics of Innovation Systems: Policy-Making in a Complex and Non-Deterministic World", mimeo; Staffan Jacobsson (2005), "'Functional Analysis' as a Tool for Policy Makers in Identifying Policy Issues in an Emerging Sectoral Innovation Systems", Chalmers University of Technology, mimeo.

[187] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Denmark, 2006*.

Innovation and is authorised to make decisions on a number of specific appropriation matters. The council, whose members are appointed by the minister, is composed in such a way that it includes competencies that are deemed essential for a viable innovation system. So far, most central stakeholders seem to be satisfied with the new institutionalization and functioning of the innovation system. However, it remains to be seen whether the recent changes will lead to a significantly better innovation-system.

In Israel, policy coordination is assigned special importance and is institutionalized through a special body, the Israeli Chief Scientists' Forum. All chief scientists of government ministries are members of this Forum, headed by the Minister of Science and Technology. The Israeli R&D system is decentralized, and each ministry is responsible for R&D in its field. Thus, the Chief Scientist Forum coordinates between the R&D centers on issues such as research fields, goals, budgets and resources. The roles of the Chief Scientists' Forum are formulated in the 2002 Law on the National Council for Research and Development (MOLMOP). The Forum meets once a month and brings to the public agenda subjects of national priority. The Forum submits an annual report to the government on the government research work plans and their main goals.

Compared to the Danish and Israeli experience towards centralization and better coordination, the national innovation systems in the catching up economies countries are still rather fragmented, with weak vertical co-ordination and absent horizontal co-ordination. For example, an OECD assessment of the functioning of the Polish NIS seems typical in this respect: 'As regards the level the governmental and legislative level, it is often argued that the Polish NIS is fragmented and often provides overlapping services. Specifically, most of the co-ordination is vertical. The horizontal co-ordination between three Ministries that deal with innovation matters has not been institutionalised yet. It is therefore justified to claim that the NIS is still not synchronised effectively (the Ministry of Science and Higher Education is responsible for the supply side of innovation - R&D – the Ministry of Economy for the demand side and the Ministry of Education for human capital development)'.[188]

An emerging tendency in a number of countries is to establish a high level *Innovation Council* as a first step towards institutionalizing horizontal coordination of innovation policy. An OECD study concludes that councils may be too narrow, as they often concentrate on core S&T policies and neglect the innovation policy potential in other ministerial domains and a co-ordination between them.[189] In any case, there is the need for integrating more systematically the different functionally organized public policies and develop a better understanding of how different policy areas shape the innovation performance.

Among other things, innovation governance sets directions and criteria for R&D funding. It also ensures horizontal and vertical coordination and aims to improve the profile of R&D and innovation based on policy analysis. In view of that complexity of innovation governance, a policy question that sometimes arises is whether there is an 'optimal' pattern of research and innovation governance (see Box L.4.1).

Box L.4.1 Lessons learned: Is there a single 'optimal' pattern of research and innovation governance?

A recent meta study addressed explicitly this issue, starting from the premise: 'It would be elegant to be able to show that countries with particular forms of research and innovation governance are systematically more successful at research, innovation and wealth production than others. In the data we

[188] OECD (2006), "Peer Review of the Policy Mix for Innovation in Poland", Draft of the country background report *Poland: Case of the Catching up Country*, September 2006, p. 14.

[189] OECD (2005), *Governance of Innovation Systems,* Vol. 1: Synthesis Report, Paris: OECD, p. 68.

have collected, we can find no evidence that this is the case.'[190] However, the expert conclusion based on the analysis of innovation governance in eight countries is that 'there is not a single 'optimal' pattern of research and innovation governance. Rather, there is a range of practices that can be more or less adapted to supporting good overall systems performance.'

Governance mechanisms differ over time in accordance with the changing national needs. Ensuring the quality of multiple inter-relationships is essential to good innovation governance. When interactions are ill suited, or inadequate, or out-dated, or non-existent, governance mechanisms can act as bottlenecks, causing system failures. 'Different national governance systems 'have individual 'styles' or cultures, which in turn are rooted in history and administrative tradition. For example, some of our case study countries have strong traditions of informal co-ordination, which go a long way towards overcoming formal gaps and imperfections in the governance structure. Others have fiercely individualistic traditions, where coordination mechanisms have to be clear and formal'.[191]

In summary, these conclusions point to what is generally known from institutional economics – optimal or best practice institutional setups are highly context specific. Hence, there is not a single 'optimal' pattern of research and innovation governance. Their 'optimality' emerges in a specific institutional context where different governance features which may be considered as inappropriate in one context work well in another.

4.2 IMPLEMENTATION OF INNOVATION AND COMPETITIVENESS POLICIES

Innovation and competitiveness policies are context dependent and it is difficult to draw any definite conclusions regarding the appropriateness of particular institutional solutions and implementation mechanisms and structures in individual countries. It is important to get a realistic understanding of how far innovation policy can go and what can reasonably be expected of it. Overall, the empirical evidence regarding the effectiveness of different instruments, mechanisms and institutional structures of innovation policy is quite mixed and does not provide straightforward policy clues.

Innovation agencies

As noted, innovation is an inter-sectoral activity of systemic nature which requires good networking and a variety of organizations that complement and articulate the market demand for R&D and innovation. From this point of view, all national innovation systems are basically composed of five key (generic) institutions supporting the innovation process:

- Governments (national, regional) that play a key role in setting broad policy directions;
- Private enterprises, clusters and business federations and associations;
- Universities and related institutions that provide key knowledge and skills;
- Bridging institutions (public laboratories, technology transfer organizations, clusters, contract research institutes, high-level councils, etc. which act as intermediaries between governments and the rest of the innovation system);
- Other public and private organizations that play a role in the national innovation system (patent offices, financial intermediaries, training organizations, standards, quality and metrology institutions, etc.).

[190] Erik Arnold, Patries Boekholt with Enrico Deiaco, Shonie McKibbin, John de la Mothe, Paul Simmonds, James Stroya, Rapela Zaman (2003), *Research and Innovation Governance in Eight Countries, A Meta-Analysis of Work Funded by EZ (Netherlands) and RCN (Norway)*, Technopolis, January, p. 55.

[191] Ibid.

The innovation process itself depends on a wide range of activities within the innovation and knowledge generating organizations like firms, universities and R&D organizations but also on organizations that facilitate linkages and undertake other non-R&D functions in the NIS. These organizations – all of which can be referred to under the broad generic tern '*innovation agencies*' – are central to innovation governance, that is, to the set of institutions and rules which affect the innovation process. These are public agencies, bridging institutions, and other public and private infrastructure organizations that play a role in the national innovation system. They facilitate interactions and connect different actors in the NIS and are essential in linking supply and demand in R&D and technology. Their network indicates the extent to which the innovation constituency is actually organized.

At the same time, during the last two decades, under the impact of new public management approaches, there has been an increase in the establishing of independent agencies, especially mandated with specific functions in the governance of innovation (see Box C.4.3). The upper levels of government (ministries) are responsible for policy while agencies are co-ordinating a number of instruments often financed by separate ministries. This process – termed *agencification* – denotes a split between the functions of policy making and implementation of policies.[192] This is a shift whereby the agencies become responsible for the implementation of the ministry's policy making. Agencies should achieve decentralization, accountability and flexibility needed for coordinating a variety of inter-sectoral programmes. They enjoy more operational freedom to ensure that managing and implementing policies can be more independent from policy making and annual fiscal constraints. Problems may emerge when agencies are not delegated sufficient freedom and strategic role. In addition, in the absence of coordination, the initial rationale for agencies loses basis.

Countries differ in the role of innovation agencies. Some countries have small ministries and big agencies while others have bigger ministries and do more policy and programme design inside those ministries. A traditional agency form is the mono-principal: an agency, which works for one ministry (for example, Enterprise Ireland, TEKES in Finland, among others). Another agency model is the "multi-principal", which acts as an intermediary for several sponsoring ministries.[193] In the developed UNECE countries, the role of the innovation agencies is changing as they are becoming more like a partner than a regulator or referee.[194]

In the catching up UNECE economies, the actors in favour of innovation policy were traditionally generally weak and disorganized and the NIS are relatively under-populated in terms of innovation agencies. The innovation constituency used to be dispersed, fragmented and thus difficult to self-organize. In the NMSs, this initially weak and dispersed innovation constituency has been enhanced and expanded through a number of accession and structural funds support programmes. These programmes have created a variety of new organizations so that some new EU member states have now quite rich network of intermediary and infrastructure organizations.

[192] OECD (2005), *Governance of Innovation Systems*, Vol. 1: Synthesis Report, Paris: OECD.

[193] Alasdair Reid (2007), "Science & Innovation in the 21st Century: Lessons for European Core and Peripheral Economies", Paper presented at the Conference 'Why Invest in Science in South-Eastern Europe?', Ljubljana, 28 September 2006 (forthcoming as chapter in UNESCO Proceedings volume).

[194] Heikki Kotilainen (2005), "Best Practice in Innovation Policy", *Technology Review*, 177/2005, Helsinki.

Box C.4.3 Country experiences: Innovation agencies

VINNOVA, the Swedish Agency for Innovation Systems[195]

VINNOVA's mission is to promote sustainable growth by developing effective innovation systems and funding problem-oriented research. Through its activities in this field, VINNOVA aims to make a significant contribution to Sweden's development into a leading centre of economic growth. In relative terms, Sweden invests more in R&D than any other country, but its long-term rate of growth has been slow in comparison with its international competitors. Policymakers have thus concluded that achieving sustainable high growth requires an increase in problem-oriented research in prioritised growth areas. To this effect, VINNOVA launches initiatives to promote problem-oriented research and the development of effective innovation systems focused on areas with a high potential for growth. One central feature of these initiatives is the development of an environment supportive to innovation. In order to prioritise effectively and promote successful initiatives, a system-based approach and an overall perspective are employed. On this basis, VINNOVA has applied foresight and analysis methods to existing innovation systems in order to identify 18 areas of growth for renewal and sustainable growth within both industry and the public sector. Amongst other things, the initiatives in these areas are supported by four knowledge platforms in biotechnology, efficient product development, learning and health in working life and IT implementation. One part of VINNOVA's contribution to the creation of an environment supportive to innovation within the growth areas is the implementation of new ventures based on the experience of the existing 23 competence centres. VINNOVA also invests in business incubators and a seed capital programme for new companies where a special need has been identified within the growth areas. In its operations, VINNOVA takes into consideration six critical prerequisites for sustainable growth within the priority growth areas: Understanding of client demand; Availability of suitable skills; Flexible labour market and sustainable working life; Venture capital; Effective IT and transport infrastructures; Strong incentives.

According to the Ministry of the Economy in Poland, the 'institutional infrastructure supporting innovation performance and the transfer of technologies to enterprises is relatively well developed, however it is regionally varied, poorly connected into one efficient and effective system and insufficiently co-financed'.[196] Since 1990, the number of innovation and enterprise centres in Poland has gradually increased, from only 27 such centres in 1990 to 266 centres in 2000 and 507 of such centres in 2004. Among 507 Polish supporting centres, there were 280 training and consulting centres, 29 technology transfer centres, 76 local credit funds, 57 credit guarantee funds, 53 enterprise incubators, and 12 technological parks.[197] These organizations are aimed at developing enterprise infrastructure and technology transfer conducting activities concerned with training sessions and consulting, financial support, technology transfer and the organization of infrastructure for small and medium enterprises. As pointed out by Polish Ministry of the Economy, the problem of the infrastructure support is its effectiveness. There is a danger that parts of the system of innovation agencies may operate as a new layer of 'intermediate bureaucracy' instead of being a true 'innovation constituency'.

CzechInvest, the Investment and Business Development Agency in the Czech Republic, was established in 2002 by the Ministry of Industry and Trade. Its main objective is to provide information, advice and support to both domestic and foreign investors. It also acts as an intermediary for SMEs with regard to EU structural funds. In the field of research and technology, it supports infrastructure for industrial research, technological development and innovation – science parks, business incubators, centres for technology transfer; assists the development of small and medium-sized enterprises; supports innovation in products, technologies and services, etc. These programmes are financed from the EU co-funded operational programme Industry and Enterprise in the form of both grants and loans.

[195] VINNOVA (2002), "Effective Innovation Systems and Problem-Oriented Research for Sustainable Growth: VINNOVA's Strategic Plan 2003-2007", VINNOVA Policy VP 2002:4.

[196] Strategy (2006), "The Strategy for Increasing the Innovativeness of the Economy for 2007-2013", Warsaw, 19th August 2006, The Ministry of Economy, The Economy Development Department.

[197] Innovation Report (2004), *Innovation and Enterprise Centre in Poland – The 2004 Report*, SOOIIP (The Institute of Economy of the University of Lodz), Lodz/Poznañ.

Enterprise Estonia was created in 2000 for advancing the business environment and increasing the competitiveness of firms in Estonia.[198] It succeeded the Estonian Technology Agency (ESTAG), formerly and until 2001 known as the Estonian Innovation Foundation. Currently Enterprise Estonia is the main intermediating agency with respect to EU Structural Funds and national R&D funds for innovation to business enterprises, but also for R&D institutions. It has mainly been recognized as a successful implementation of international policy learning, but here have been three different barriers at the policy level identified that are to be dealt with in the future:

• The qualification of project evaluators and experts is generally very diverse and sometimes not responding to the field of technology or sector. In some cases, the evaluation criteria for applications are differently understood and not supporting the selection of best projects for funding;
• The support budgets are too small as compared to the demand in some programmes;
• The beneficiaries are not satisfied with the complicated reporting schemes and the perceived red tape.

Implementation models

The effectiveness of innovation policy depends on the overall design and as well as on the way policy instruments are combined into policy mixes that offer complementary and mutually reinforcing support for national innovation systems. The countries in the UNECE region differ considerably in terms of the policy mixes for innovation, even if many of the policy instruments are quite similar. However, the biggest differences between developed and catching-up UNECE economies lay in the implementation of individual policy instruments for innovation (see also Box L.4.2). The quality of implementation is what distinguishes true from surrogate societal modernization. In particular, this relates to coordination mechanisms which formally do exist in the catching-up countries but do not operate properly. For example, in all NMSs, new bodies have been established in charge of so the called 'Lisbon strategy'. Yet, these bodies are either weak or are not really working.[199] In addition, weak involvement of stakeholders, in particular of the business sector, results in poor implementation of seemingly well designed policies and policy mixes.

Another aspect of innovation governance and policy implementation refers to the division of labour between ministries and agencies. In a pure theoretical model, *policy design* is the responsibility of the ministry following political decisions taken by government and *policy implementation* is dealt with by the agencies on the instruction of the ministry. However, as demonstrated in Figure 3, the border lines between policy design and policy implementation are more complex.

[198] Jaan Masso, Kadri Ukrainski (2007), "Public Funding of Research in Estonia", Report prepared for the project 'Public funding of research in Central and Eastern European countries', PRIME Network of Excellence, mimeo (draft).

[199] Detailed evidence on this issue can be found in forthcoming European Trend Chart on Innovation annual reports for new member states.

Figure 3: Approaches to sharing the responsibilities for the design and implementation of innovation policy

Country	Policy Design	Programme design	Programme management	Programme administration tasks
Latvia	Full Responsibility Ministry		Shared responsibility	Full responsibility Agency
France	Full Responsibility Ministry	Full responsibility Agency		
Portugal	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
Ireland	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
The Netherlands	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
Luxembourg	Full Responsibility Ministry	Shared responsibility	Full responsibility Agency	
Finland	Shared responsibility	Full responsibility Agency		
Flanders	Shared responsibility		Full responsibility Agency	
Estonia	Shared responsibility		Full responsibility Agency	
Austria	Shared responsibility		Full responsibility Agency	
Slovenia	Shared responsibility		Full responsibility Agency	
Slovakia	Shared responsibility		Full responsibility Agency	

Source: Technopolis, Trend Chart Policy Workshop: A European Innovation Agency? How to improve innovation policy governance in Europe? Workshop Output Paper.

Implementation agencies exists in twelve out of 21 countries presented in Figure 3 and in eleven countries, the agencies have a role in policy design as well. In nine countries another organization has the responsibility for programme management and administration. A valid conclusion from this picture is that the effectiveness and efficiency of the governance-*cum*-implementation system is not related to the type of model adopted.[200] One example of the implementation challenge is the process of implementation of the Technology Plan in Portugal (Box C.4.4)

Box L.4.2 Lessons learned: Implementation specificities and why is innovation performance still poor in the catching up economies?

Innovation policy in the catching up UNECE economies has several distinctive features which stem from lower levels of development and S&T legacies of the past. The effect of past legacies is that their innovation systems are still weak in diffusion and in firm R&D, two aspects in which socialist economies had systemic deficiencies. Accordingly, two common trends in the catching up economies are: (i) a shift towards diffusion oriented activities within R&D system, and (ii) transformation towards enterprises based R&D system. Other common trends in the innovation policy design and implementation in the catching up economies are:[201]

· A significant effort to increase the availability and competencies of skilled innovative people;

[200] Alasdair Reid (2007), "Science & Innovation in the 21st Century: Lessons for European Core and Peripheral Economies", Paper presented at the Conference 'Why Invest in Science in South-Eastern Europe?',Ljubljana, 28 September 2006 (forthcoming as chapter in UNESCO Proceedings volume).

[201] Ibid

· A need to strengthen linkages and knowledge flows both nationally and internationally, in particular, through partnership based initiatives to create linkages aimed at improving the functioning of innovation systems like "triple-helix", clusters, competitiveness poles, etc., and new platforms for policy design and delivery;
· A growing regional role in the implementation of many recent initiatives (fuelled by the Structural Funds in the NMSs) corresponding to a need for coordination with national targets and initiatives;
· A push to increase the overall intensity of innovation activity through stimulating private enterprises to invest more in R&D, specifically, and other forms of innovation more generally;
· An emphasis on the role of regulations, public procurement and other 'business 'environment factors influencing the performance of the NIS.

Among several possible explanations of the relatively poor innovation performance in the catching up UNECE economies, two seem to be relevant:

First, a variety of factors that fall within the framework conditions are contributing significantly to poor innovation performance. These framework conditions factors have less to do with poor macroeconomic situation but have more to do with the structure of the economy, the level and type of competition, standards and regulation, the overall entrepreneurship culture, human resources, the quality and directions of projects conducted by the publicly financed R&D units. These factors have so unfavourable impacts on innovation activities of firms that the incentives provided by innovation policy schemes cannot counterbalance those effects.

Second, innovation policy programmes are poorly implemented in the sense that there is a wide range of instruments affecting R&D and innovation '… from direct measures to indirect measures such as tax incentives as well as in the number of innovation stakeholder – especially at the down-stream implementation level [but] – whose offer is rarely matching the expectations of the private sector'.[202] In view of the recent implementation of the majority of innovation promotion measures, any final judgment would be premature. However, there seems to be a large scope for changes at the level of policy design and implementation. As pointed out by the most important are improvements in terms of up-to-date decision-preparatory methods – most notably thorough analyses of innovation performance, combining census, R&D and innovation data; evaluation of individual policy measures, as well as that of the policy mix as a whole; and technology assessment.[203]

Policy implementation and innovation performance

The range of policy measures in targeting innovation-based competitiveness in the majority of the UNECE catching up economies is relatively broad and designed to respond to the most important challenges. Most of the measures targeting innovation in the NMSs are new as they are mainly financed through the EU Structural Funds. Among the EECCAs, several countries, in particular, Russia, have also instituted a large number of new innovation policy measures. In short, significant progress has been made with respect to support mechanisms favouring the development of innovation over the last years in most of the UNECE catching up economies. For example, an OECD assessment of Polish innovation policy concludes that 'significant progress has been made with respect to support mechanisms favouring the development of innovation over the last years'.[204]

[202] OECD (2006), "Peer Review of the Policy Mix for Innovation in Poland", Draft of the country background report *Poland: Case of the Catching up Country*, September 2006. p.16

[203] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Hungary, 2007* (draft).

[204] OECD (2006), "Peer Review of the Policy Mix for Innovation in Poland", Draft of the country background report *Poland: Case of the Catching up Country*, September 2006, p.14.

Nevertheless, what counts in the end is innovation performance and here the outcomes are rather mixed. Among the NMSs, Hungary represents a good example as it is country where there are 'a large number of apparently relevant STI policy schemes to foster RTDI activities, and yet, innovation performance is rather poor'.[205] In summary, many catching up economies have developed innovation policy instruments but their effects in terms of innovation performance are not yet visible (Box L.4.2).

Box C.4.4 Country experiences: The challenge of implementing the Technology Plan in Portugal

The Technological Plan of Portugal is contains a policy agenda and a political commitment to promote Portugal's development and competitiveness based on knowledge, technology and innovation. The Technological Plan includes a set of measures (altogether 112 measures spread over 3 lines) which reflect the Government commitment and the priorities for the Portuguese society. Each measure is monitored by the coordinators of the Technological Plan through a monitoring platform.

The implementation of the measures set out in the Technological Plan are subject to a regular follow-up by Government bodies, the general public and a group of qualified specialists from the innovation area. To do so, the following mechanisms will be involved:
1. Inter-Ministerial Follow-Up Committee: a group of high-level representatives of the key ministries participating in the implementation of the Technological Plan, with the objective of identifying, monitoring and evaluating initiatives within the scope of this Plan.
2. Consultative Council: a group of specialists from the innovation area (including representatives from civil society, namely entrepreneurs, scholars and policy makers) that meet periodically to review a progress report of the Technological Plan. The Council de facto acts as progress evaluator.
3. Public Access: the portal associated to the Technological Plan publicises updated progress of the Plan, covering the above indicators and serving as an information channel for the general public and the media.

The guidelines of the Technological Plan are only binding on public policies, institutions and groups. Nevertheless its success will largely depend on the support of other bodies and agents from the civil society, namely enterprises, higher education institutions, research centres and institutions, and other entities from the innovation system. It will also depend on the commitment and competency of public and private entities, for the individual or joint implementation of the proposed measures and initiatives. This collective participation effort is the starting point for the consolidation of a shared vision that may function as a catalyser for change. Coordination and follow-up are essential to promote the necessary partnerships and to enhance the complementarities between policies.

4.3 ASSESSMENT OF THE EFFECTS OF POLICIES

As noted earlier, the prevailing expert view is that no 'optimal model' of innovation governance exist in terms of boxes and organograms. Hence, in assessing innovation and competitiveness policies and comparing the different implementation models across countries, it is necessary to go beyond national policy making and delivery structures, that is, beyond boxes and organograms. An alternative is to compare and appraise the portfolio of policy measures and the quality of the policy process. In this regard, national policy mixes are still largely dominated by public funding of research activities though, as pointed out in a recent EC assessment, 'the evolution has been to move towards a wider range of funding schemes, going beyond the traditional elements of institutional finding of public research

[205] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Hungary, 2007* (draft).

institutes and subsidies for project based research and now including e.g. loan and guarantee schemes, equity, fiscal incentives, and instruments such as procurement (of R&D services notably)'. [206]

Assessing the policy mix assumes appraising its comprehensiveness, relevance and orientation. Evaluating the comprehensiveness of the policy mix refers to the appraisal of the number of areas and stages of innovation process addressed by policy. Assessing the relevance of the policy mix requires understanding of what are the specific strengths and weaknesses of the country's innovation system which require a country specific policy mix. Evaluating the orientation of the policy mix requires understanding of:

- The focus of innovation policy instruments (for example, absorption, R&D, diffusion, demand);
- The interrelationship between research and innovation orientation;
- The types of instruments used (for example, systemic, individual, mixed, etc.);
- The importance of funding agencies;
- Whether innovation policy is oriented towards active (such as clusters, R&D programmes, etc.) or passive instruments (taxes, subsides, etc.).

The main differences between two seemingly similar policy mixes are in the effectiveness of policy making process. This includes assessment of the information sources and the quality of strategic intelligence; the quality of priorities determination, the design of policy measures and the development of evaluation culture. Policy learning rests on widespread evaluation culture which stimulates collective learning in innovation community.

In developed UNECE economies, evaluation practices are on average quite elaborate but, as pointed by country representatives, they are rarely used, and when used it is usually always in a retrospective vein. While there is no systematic overview of innovation policies across all UNECE catching up economies, evaluation practices are in general underdeveloped in these countries.[207] An important specificity of the catching up economies is a stronger need for evaluation of RTD organizations. This applies not only to regular annual or medium-term assessment of RTD organizations but also to institutional assessment with the objective to restructure RTD system by altering the structure and organization of research institutes and their research activities.

[206] EC (2007), Commission Staff Working Document Accompanying the Green Paper 'The European Research Area: New Perspectives', Brussels, COM(2007)161 , p. 35.

[207] An example which seems typical in this respect is an evaluation of the university-industry support system in Poland: 'The majority of innovation centres in Poland is providing the trainings services that do not considerably stimulate the business enterprises innovativeness. The quality of the services they render is also below expectations, which may stem from the financial problems many of those innovation support institutions face, as well as barriers hampering their development (poor economy conditions in the region, lack of financial sources for development and expending of their offer, weak cooperation with local and regional institutions). Moreover, the lack of professional staff experience in the area of innovation, especially transfer of technologies and its commercialization, may also contribute to low quality of their offer. Additionally, in case of innovation supporting institutions there is a structural gap between Poland and EU as well as others developed countries – there are no entities supporting the innovation projects after the finalization of R&D and before launching implementation phase. … (However,) It should be stressed, that it is too early to assess the effectiveness of the measures undertaken at both central and local level with a view to stimulating science-industry linkages in Poland'. OECD (2006), "Peer Review of the Policy Mix for Innovation in Poland", Draft of the country background report *Poland: Case of the Catching up Country*, September 2006.

Nevertheless, it should be pointed out that the number of instruments and mechanisms of innovation and competitiveness policies has increased in all catching up economies but the emerging issue becomes their individual effectiveness and the overall coherence of the policy mix. In assessing the effectiveness and coherence of innovation promotion, two issues need to be borne in mind:

- First, the effectiveness of individual policy instruments should be considered in the context of the national innovation systems and their specific objectives in this system. Each instrument should be considered in the context of the wider policy portfolio and the innovation system in which it operates. It is the synergy and interaction that make for an effective package of policy instruments to have the best effect. In this way relative effectiveness measurement can be done using a mix of methodological approaches, as well as a wider consultation process with the stakeholders and users of policy instruments.
- Second, appropriate governance systems appear necessary (or, at least, helpful) for good NIS performance, but are not sufficient to cause it. Innovation performance is an outcome of broader range of factors which go beyond innovation policy proper and encompass framework conditions and a variety of non-technological factors.

Evaluation culture in innovation policy

Evaluation is 'a process that seeks to determine as systematically and objectively as possible the relevance, efficiency and effect of an activity in terms of its objectives, including the analysis of the implementation and administrative management of such activities'.[208] Evaluation is far from being and 'exact' science. There is not one satisfactory method of evaluation due to three endemic problems:[209]

- *attribution*: how can one isolate the effect of a policy instrument on the performance of a firm or a group of firms, given the many additional factors that influence that performance?
- *time lag* between research, innovation and economic effects for those directly involved in the programme and even more for those not participating in the programme;
- *qualitative effects* that are included in the objectives of the programme such as networking, improving the absorptive capacity and competences of firms are not amenable to quantifications.

None of the existing evaluation methods works well on its own. It is important to use a combination of methods and to test for consistency between the findings emerging from each. The level of evaluation cultures differs widely across the UNECE member states. The EC Trendchart annual report distinguishes three levels of innovation cultures across 33 Trendchart countries (see also Box C.4.5):[210]

- Countries where there is a conscientious and systematic effort to apply policy studies and evaluations (Belgium, Finland, the Netherlands, Switzerland and the UK);
- Countries where there are many appraisal and evaluation activities but this process is not yet culturally embedded (most of the developed EU economies such as Austria,

[208] Programme (2006), *National Reform Programme for 2005-2008 to Implement the Lisbon Strategy: First Annual Progress Report*, Adopted by the Council of Ministers of Poland on 13 October 2006, p.52.

[209] Patries Boekholt et al. (2001), "An International Review of Methods to Measure Relative Effectiveness of Technology Policy Instruments", FINAL REPORT JULY 2001 (available at http://www.technopolis-group.com/downloads/reports/261_EZ_Final_010723.pdf).

[210] Trendchart (2004), *Innovation Policy in Europe 2004.* EC DG Enterprise and Industry.

Denmark, France, Germany, Ireland, Luxembourg, Norway and Sweden, as well as Estonia, belong to this group);

- Countries with marginal evaluation activities (the rest, or 19 out 33 countries). The EECCA countries which are not part of the Trendchart monitoring system belong to this third group as well.

Box C.4.5 Country experiences: Evaluation of innovation policies

According to the EC Trendchart assessment, Denmark has no tradition of systematic evaluations of all innovation policy initiatives.[211] Evaluations have generally been carried out in an ad hoc manner, and only some initiatives have been evaluated. Past evaluations (a number of evaluations/analyses have been carried out) have, at most, had implications for the specific initiatives that were evaluated. This is, however, one aspect of Danish policy in general that policy makers aim to improve. Evaluation is accordingly given a high priority in the recent Globalization Strategy, where it is proposed that substantial efforts should be made to create of a systematic evaluation culture.

By contrast, in the U.K., there is a strong evaluation culture. The assessment, monitoring and ongoing evaluation of measure is broadly accepted through the government machinery. Methods and techniques have been changing in response to evolving circumstances. Currently, a business case needs to be made for proposed measures, which includes useful information for subsequent evaluation, including option appraisal, cost-benefit analysis, a logic model defining inputs and expected outcomes and a balanced scorecard which incorporates a set of relevant indicators for tracking progress and evaluating outcomes. The results of the evaluations are generally public but not always publicised, which makes difficult locating relevant reports.[212]

An evaluation culture is gradually developing in Latvia,[213] especially as regards the evaluation of research project proposals and their execution. Such evaluations are systematic and are undertaken once a year. There is less experience with the evaluation of innovation policy measures, which is undertaken on an irregular basis given the comparatively recent introduction of such measures. The Ministry of the Economy currently manages evaluations, both prior to the introduction of measures and during the course of their operation. An ex ante evaluation, for example, was undertaken in 2006 with respect to the competence centre programme. A mid-term evaluation of the policy measure "Support to the development of new products and technologies" was carried out in 2004-2005, resulting in a number of changes made in several provisions of the measure. Nevertheless, full evaluation procedures are yet to be developed.

In Hungary, the Law on Research and Technological Innovation, which came into force in 2005, made the evaluation of STI policy programmes compulsory. However, the evaluation culture is still underdeveloped and there is lack of thorough and evidence-based evaluation practices. In the case of measures financed exclusively by national resources, there is no ex-ante evaluation (impact analyses) prior to their introduction, which could establish if the proposed measures are the most efficient tools to achieve the intended goals. There is no evaluation of the previous rounds of on-going schemes, and recently concluded ones, either. As a result, it is difficult to assess whether the chosen tools applied to advance the goals of a specific measure are the appropriate ones. [214]

[211] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Denmark, 2006*, p. 44.

[212] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: United Kingdom, 2006*.

[213] European Trend Chart on Innovation (2006), *Annual Innovation Policy Trends and Appraisal Report: Latvia, 2006*, p.11.

[214] European Trend Chart on Innovation (2007), *Annual Innovation Policy Trends and Appraisal Report: Hungary, 2007* (draft).

Attempts to create systematic procedures of innovation policy evaluation are underway in some NMSs (for example, Poland, among others). In general, governments should give evaluation a more prominent role by linking it closely to strategic decision making, and not only linked to programme management.

4.4 LEARNING FROM GOOD PRACTICES IN INNOVATION AND COMPETITIVENESS POLICIES

According to recent assessments, three trends dominate innovation policy in the majority of the UNECE economies:[215]

- A significant effort to strengthen linkages and knowledge flows both nationally and internationally. This is reflected in partnership-based initiatives to create linkages like "triple-helix", clusters, competitiveness poles, and new mechanisms for policy design and delivery like EU technology platforms aimed at improving the functioning of innovation systems;
- An increase in the overall intensity of innovation activity through stimulating private enterprises to invest more in R&D, specifically, and other forms of innovation more generally;
- An emerging emphasis on the role of regulations, public procurement and other business environment factors influencing the performance of the innovation systems.

These trends are reflected in innovation policy practice, where there is a shift towards the so-called systemic instruments. However, this tendency is far from sufficient to explain what is good (best) practice of innovation policy.

The issue of good practice in innovation policy

Based on the established trends in innovation policy, good practices in innovation support systems are those that enhance synergies and weak links. However, this does not answer question what is good practice in innovation policy. The notion of best practice in innovation policy is highly controversial. As pointed out by experts 'you cannot easily transplant a 'high performance element' from one system to another and expect the impact to be similar to what it was in the system of origin. While there is a lot to learn from intelligent comparisons across national systems (learning-by-comparing) naïve benchmarking of narrowly defined areas in search of a single 'best-practice' and neglecting the systemic context leads to negative results'.[216]

The complexity of discovering what is good practice in innovation policy stems from the fact that identical functions in innovation systems may be undertaken by different institutions. This means that one cannot identify and distinguish good practice by simply pointing to the 'right institutions' as there is no one-to-one relationship between functions and institutions. Taken out of context the observed institutions, routines or successful cases may not be strictly comparable. There is not a single 'optimal' pattern of research and innovation governance as

[215] EC Trendchart (2006), *The European Innovation Progress Report 2006*, EUR 22410.

[216] Bengt-Åke Lundvall (2006), "Innovation Systems between Policy and Research", Presentation at 'Innovation Pressure Conference', Tampere, March 2006, mimeo, p. 12.

identical functions could be undertaken by different institutions. Hence, relations between framework conditions and public support for innovation are country specific. In more general terms, it has been established that:[217]

- there is not one 'optimum design' or 'best practice';
- policy systems are context and path dependent;
- what might work well in one country might not go down well in another one.

This applies also to the choice of indicators for benchmarking. A country doing 'badly' on one indicator may be doing rather better on another. This requires 'intelligent benchmarking' where indicators are set within the national/regional/global context within which they are embedded.[218] In particular, this limits the usefulness of global indicators like WEF Global Competitiveness Index or European Innovation Scoreboard indicators as possible practical tools to be used to design or fine tune policies.

Box L.4.3 Lessons learned: Evaluation and policy learning practices

Some key lessons from evaluation and policy learning practices in the OECD countries are: [219]
· Policy learning takes place mostly ex ante through mechanisms like White Papers and less through ex post evaluation and follow-up of programmes.
· Most countries have organizational mechanisms like task forces that can enhance learning if exploited properly.
· It is increasingly necessary to conduct more systemic evaluations of innovation policies to gain a better understanding of their interactions and impacts.
· The agency level should be well equipped with strategic and intelligence functions to better co-ordinate governance levels.
· Fragmented governance structures often represent a loss of strategic capacity, and governments should pay more attention to improving mutual understanding of innovation-related issues across ministries

Good practice and "strategic intelligence"

Whatever is considered as good practice rests on strategic intelligence. Why good practice needs strategic intelligence? In a systemic world, which is abundant in the complexity of linkages between different social and technical subsystems, policy makers increasingly need "strategic intelligence". 'Strategic intelligence' is essential to: [220]

- understand the underlying determinants of R&D and innovation;
- answer to immediate policy questions;
- anticipate trends and future developments related to innovation policy;
- monitor progress in policy areas and understand the impact of policy measures,
- adapt agencies and other institutions over time to changing forms of policy measures.

[217] OECD (2005), *Governance of Innovation Systems, Vol. 1: Synthesis Report*, OECD, Paris

[218] Bengt-Åke Lundvall and Mark Tomlinson (2002), "International Benchmarking as a Policy Learning Tool", in: Maria Joao Rodrigues (ed.), *The New Knowledge Economy in Europe*, Cheltenham: Edward Elgar, pp. 203-231.

[219] OECD (2005), *Governance of Innovation Systems, Vol. 1: Synthesis Report*, OECD, Paris p. 13/14):

[220] Alasdair Reid (2007), "Science and Innovation in the 21st Century: Lessons for European Core and Peripheral Economies", Paper presented at the Conference 'Why Invest in Science in South-Eastern Europe?', Ljubljana, 28 September 2006 (forthcoming as chapter in UNESCO Proceedings volume).

In practice, strategic intelligence is often 'limited to *ex post* evaluations or seen as an activity at the end of a policy cycle. To ensure co-ordination and integration and achieve better governance, policy learning needs to be built into the whole cycle of policy making':[221]

The main tools of strategic intelligence are instruments like foresight, innovation indicators, benchmarking, systematic evaluation cycle, and transnational policy learning. Examples of tools of policy benchmarking are exercises like Trendchart and ERA Watch. Cultural affinity and geographical proximity drive initial transnational policy learning. Also, it has been established that latecomers tend to learn more from others.

Strategic intelligence requires a developed culture of evaluation. Across the UNECE region, the culture of evaluation is developed to a very uneven extent, which indirectly indicates an uneven development of strategic intelligence (on policy learning with respect to evaluation see also Box L.4.3). In the more advanced countries, evaluation is becoming an integral part of a learning-based approach to policymaking and programme formation.

[221] OECD (2005), *Governance of Innovation Systems, Vol. 1: Synthesis Report*, Paris: OECD.