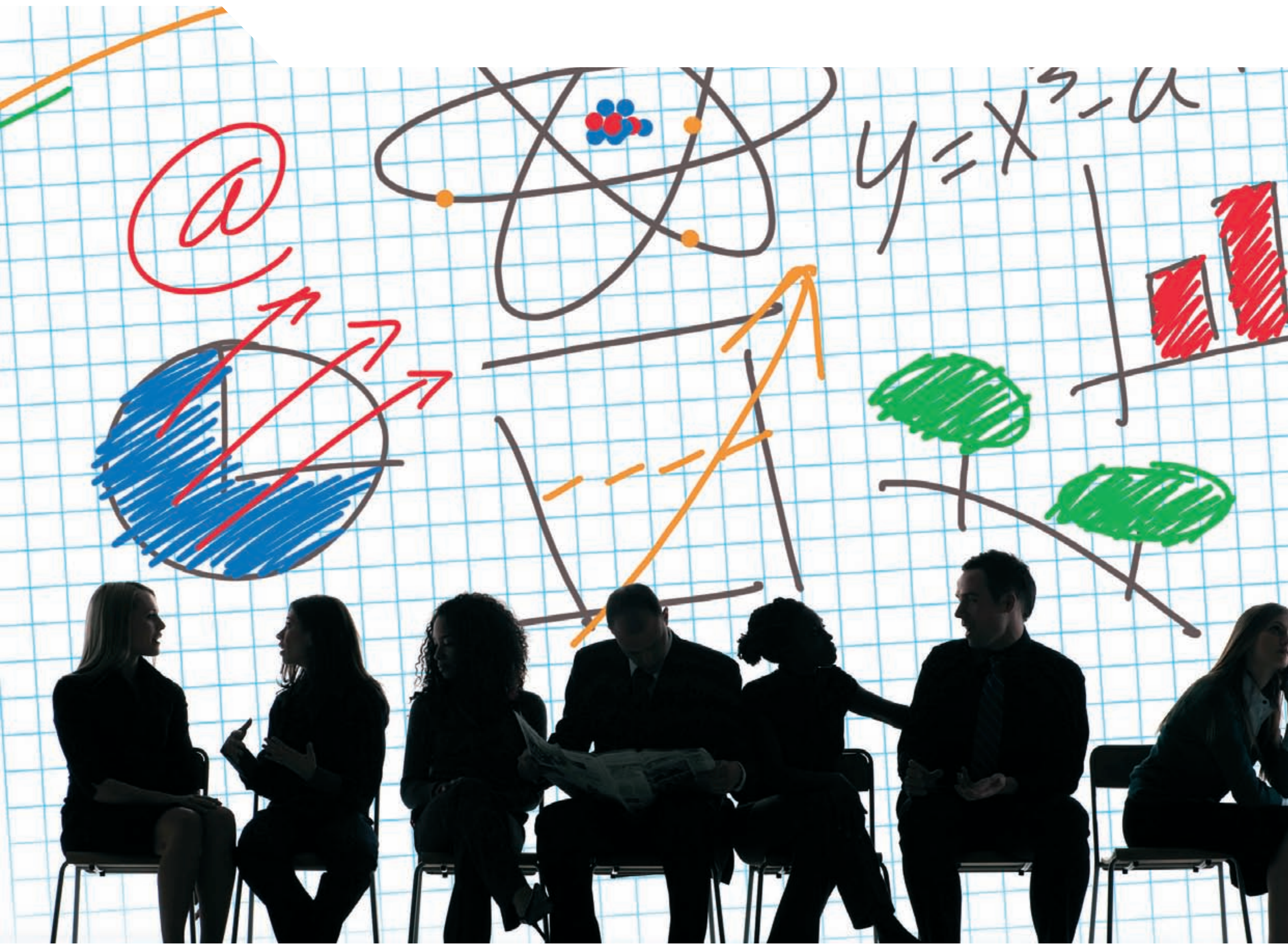
OECD Reviews of Regional Innovation

# Regions and Innovation Policy



OECD Innovation Strategy

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OECD Reviews of Regional Innovation

# Regions and Innovation Policy

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# *Foreword*

*Sustainable growth at regional level is now, more than ever, predicated on the capacity to innovate. This publication focuses on two main questions:*

- *How can regional actors support innovation that is relevant for their specific regional context, building on their human and physical assets?*
- *How should national innovation policies take into account this regional dimension, the local nodes in global networks?*

*The interdependence of roles and responsibilities for innovation in a multi-level governance environment is a new area for OECD member countries. The recommendations put forward in this publication are addressed to national policy makers as well as to the regions themselves.*

*Part I offers a framework to develop a regional roadmap with a smart policy mix, building on innovation dynamics, and the policy approaches to support them. Effective governance arrangements are discussed, within the region among both public and private actors, as well as across levels of government. Part II provides elements of a "how-to" approach for the implementation of policy instruments. Regional innovation agencies, for example, are often used to bring together public and private interests behind regional strategies. Regional-level data and country pages are also included as a reference tool.*

*The OECD launched in 2007 the series* OECD Reviews of Regional Innovation. *Thematic reports include* Competitive Regional Clusters: National Policy Approaches *and* Globalisation and Regional Economies: Can OECD Economies Compete in Global Industries? *along with this publication. Reviews of specific regions have been conducted thus far in the North of England (United Kingdom), Piedmont (Italy), 15 Mexican States, Catalonia (Spain), and the Basque Country (Spain). This work has contributed to the OECD Innovation Strategy.*

*I believe this publication can offer a framework and benchmarks both to design regional innovation policies and to ensure that economy-wide policies take the regional dimensions properly into account. The OECD will continue to support this critical policy agenda in our member countries.*

Rolf Alter
Director
Public Governance and Territorial
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This report was co-ordinated by Karen Maguire and drafted by Karen Maguire, Claire Nauwelaers and Annalisa Primi under the direction of Joaquim Oliveira Martins, Head of the Regional Development Policy Division. Adam Ostry provided extensive comments. Giulia Ajmone Marsan provided statistical support. Luc Soete, Director of the United Nations University-Maastricht Economic and Social Research and Training Centre on Innovation and Technology (UNU-MERIT) provided the preface. Paul Benneworth, Senior Researcher, Center for Higher Education Policy Studies, University of Twente, served as a Scientific Advisor to this project and provided a thematic background report. Other thematic background report contributions were made by Andrea Bonaccorsi, Professor of Economics and Management at the University of Pisa (Italy); David Charles, Curtin Business School, Curtin University of Technology (Australia); Elvira Uyarra, Research Fellow, Manchester Business School, Manchester University (United Kingdom); and Alasdair Reid, Cristina Navarrete, Lorena Rivera and Alo Merilo of Technopolis (Belgium).

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# Acronyms

| | |
|---|---|
| ACC1Ó | Catalan Innovation Support Agency |
| BCG | Boston Consulting Group |
| BELSPO | Belgian Science Policy Office |
| BERD | Business enterprise expenditure on research and development |
| CCDR | Commissions for Regional Co-ordination and Development, Portugal |
| CDTI | Centre for the Development of Industrial Technology, Spain |
| CGEE | *Centro de Gestão e Estudos Estratégicos*, Brazil |
| Cluster IP | European Innovation Platforms for Clusters |
| CMM | *Communauté métropolitaine de Montréal* |
| COECYTJAL | State of Jalisco's S&T Council, Mexico |
| CONACYT | National Council for Science and Technology, Mexico |
| CPB | Bureau for Economic Policy Analysis, Netherlands |
| CPER | *Contrat de projet État-région*, France |
| CRITT | Centres for Research and Technology Transfer, France |
| CTFCA | Canadian Transportation Fuel Cell Alliance |
| DATAR | Inter-ministerial Delegation for Regional Planning and Attractiveness, France |
| DEACA | Danish Enterprise and Construction Authority |
| DGCIS | *Direction générale de la Compétitivité, de l'Industrie et des Services*, France |
| DRIRE | *Direction régionale de l'industrie, de la recherche et de l'environnement*, France |
| DRRT | *Délégué régional à la recherche et à la technologie*, France |
| EC | European Commission |
| ELY centres | Centres for Economic Development, Transport and the Environment, Finland |
| EPEC | European Policy Evaluation Consortium |
| ERDF | European Regional Development Fund |
| ERICarts | European Institute for Comparative Cultural Research |
| ESI | Embedded Systems Institute, Netherlands |
| EU | European Union |
| EUR | Euro |
| EUROLIO | European Local Innovation Observatory |
| FDI | Foreign direct investment |

| | |
|---|---|
| FECYT | *Fundación Española para la Ciencia y la Tecnología*, Spain |
| FORTH | Foundation for Research and Technology Hellas, Greece |
| FP | Framework Programme, EU |
| FTQ | *Fonds de solidarité des travailleurs du Québec*, Canada |
| FVM | Fukuoka Venture Market, Japan |
| GBOARD | Government budget appropriations or outlays for research and development |
| GDP | Gross domestic product |
| GEM | Global Entrepreneurship Monitor |
| GERD | Gross domestic expenditure on research and development |
| GTA | Greater Toronto Area, Canada |
| GVA | Gross value added |
| GWK | The Joint Conference of Science, Germany |
| HEI | Higher education institution |
| HTM | High- and medium-high-technology manufacturing |
| IADB | Inter-American Development Bank |
| IAS | The Innovation Advisory Service, United Kingdom |
| ICT | Information and communications technologies |
| IDC | Industrial development centres, Sweden |
| IM | Innovation Management |
| INE | Spanish Statistical Institute |
| IPC | International patent classification |
| IPR | Intellectual property rights |
| IRE | Innovative Regions in Europe |
| ISCED | International Standard Classification of Education |
| IWT | Institute for the Promotion of Innovation by Science and Technology, Flanders (Belgium) |
| KIPF | Korea Institute of Public Finance |
| KIS | Knowledge-intensive services |
| KVP1 | Kyushu Venture Partners 1, Japan |
| LIMA | Integrated Laboratory for Advanced Methodologies, Italy |
| MAS | Manufacturing Advisory Service, United Kingdom |
| MCT | Ministry of Science and Technology, Brazil |
| MED and MEE | Ministry of Education and Ministry of Economic Development, Finland |
| MEEC | Ministry of Enterprise, Energy and Communications, Sweden |
| MEP | Manufacturing Extension Partnerships, United States |
| METI | Ministry of Economy, Trade and Industry, Japan |
| MEXT | Ministry of Education, Culture, Sports, Science and Technology, Japan |
| MISE | Ministry of Economic Development, Italy |
| MTI | Ministry of Trade and Industry, Finland |

| | |
|---|---|
| NACE | Nomenclature of economic activities, European Community |
| NBIA | National Business Incubation Association, United States |
| NCE | National Centres of Expertise, Norway |
| NEFA | New England Foundation for the Arts, United States |
| NESTA | National Endowment for Science, Technology and the Arts, United Kingdom |
| NIS | National innovation system |
| NRC | National Research Council, Canada |
| NTBFs | New technology-based firms |
| NUTS | *Nomenclature d'unités territoriales statistiques* |
| OECD | Organisation for Economic Co-operation and Development |
| P1 | Point-One Programme, Netherlands |
| PCT | Patent Co-operation Treaty |
| PISA | OECD Programme for International Student Assessment |
| PPP | Public-private partnerships |
| PPP | Purchasing power parity |
| R&D/ R&D&I | Research and development/ Research and development and innovation |
| RDA | Regional development agency |
| RIA | Regional innovation agency |
| RIS | Regional innovation system |
| RIST | Regional Innovation, Science and Technology, United Kingdom |
| RITTS | Regional Innovation and Technology Transfer Strategies and Infrastructures, European Union |
| ROM | Regional development companies, Netherlands |
| RTDI | Research, technological development and Innovation |
| RTO | Research and technology organisation |
| S&T/ STI | Science and technology/science and technology and innovation |
| SBA | Small Business Administration, United States |
| SBDC | Small business development centers, United States and Mexico |
| SCK | Nuclear Energy Research Center |
| SKA | Square Kilometre Array |
| SME | Small and medium-sized enterprise |
| TDPC | Territorial Development Policy Committee, OECD |
| TL | Territorial level |
| TSER | Targeted Socio-Economic Research, European Union |
| UNU-MERIT | United Nations University-Maastricht Economic and Social Research and Training Centre on Innovation and Technology |
| VAT | Value added tax |
| VC | Venture capital |
| VIS | Flemish Co-operative Innovation Networks, Belgium |

| | |
|---|---|
| VITO | Flemish Institute for Technological Research, Belgium |
| VRWB | Flemish Council for Science Policy, Belgium |
| WMES | West Midlands Economic Strategy, United Kingdom |

# Preface

## Regions and innovation policy: the way forward

For many decades now, economists have known that long-term, sustainable economic growth cannot simply be explained by increases in physical capital, natural resources or population. The accumulation of physical capital – investments in machines, buildings, roads – will increase economic output in the short run, but the mere addition of physical capital does not guarantee long-term economic growth, given the emergence of so-called marginal diminishing returns in the process of such capital accumulation. This is even more true in the case of natural resources and population growth or increased employment participation. Ultimately, long-term sustainable growth will depend on knowledge accumulation, either embodied, in smarter capital, a more efficient use of natural resources and a better-educated labour force, or disembodied, for example, as codified in patents, copyrights or trademarks. Knowledge accumulation depends on investment in education, including tertiary education, training and lifelong learning, accumulated scientific knowledge and technological advancement, and on social and institutional development. The general consensus in the literature today is that the driving force behind long-term economic growth is science, technology and innovation in its different forms and facets.

The notion that technological knowledge is the principal source of sustainable growth leads to the evidence-based observation that the huge, long-term differences in growth across countries and regions can be explained by differences in knowledge, productivity and technology. The fact that these inequities exist, in turn, conflicts with the simplistic view of knowledge as representing a global public good, available to everyone, everywhere. Of course, science and technology do to some extent have the characteristics of a public good that is freely accessible and easily appropriated. But increasingly, scientific knowledge has become proprietary, and turned more to private profit than public benefit. Maintaining and exploiting technological knowledge today often demands expertise and skills that can only be cumulatively acquired, by building on a mastery of existing knowledge.

This dual nature of knowledge as both a public and a private good gives technological knowledge a double-edged role in economic development. It is a source both of divergence and of convergence among firms, sectors, regions and countries. When knowledge is freely accessible, as in the case of public science or some of the features of the information and communication technology revolution (for example, mobile communication), the spillover effects permit convergence and catch-up worldwide. However, the proprietary nature of technological knowledge often underlies the lasting and increasing income differences among regions and nations. Because knowledge has a strong cumulative and tacit character, and is embedded in the organisational structure of firms, networks and institutions, it is often costly to transfer from one setting to another.

In the two hundred years since the Industrial Revolution, and in particular since the competition for industrial productivity that began in the last quarter of the 19th century, the economies of many of the regions and nations considered rich today have progressively expanded, while the poorest, least-developed regions have fallen behind. Nowhere was this better illustrated than in the polarisation of innovation in Europe, during its process of economic integration, as technological hot spots emerged in certain regions and as other regions fell behind in terms of the average European performance. The pattern of knowledge growth centres now extends well beyond the core research centres referred to in many EU reports in the 1980s as a geographical "banana" running across the EU member states, from southeast England to Lombardy and Catalonia. It now includes research concentrations in more recent member states, such as in Sweden/Denmark (Öresund), Finland, Hungary, the Czech Republic and the Slovak Republic. At the same time, further economic disparities emerged in a broadly similar fashion from such regions in the old EU as southern Italy and spread to new peripheral regions. Those on the outskirts of Europe or farthest from the European centre are clearly at a disadvantage as regards knowledge accumulation and innovation.[1] Social cohesion, such as regional growth convergence, was an intrinsic part of the mission of the EU, which has devoted considerable Structural Funds towards investment in knowledge activities. This has coincided with the core messages of the OECD Innovation Strategy, whose focus has expanded from pure research and technology development support towards innovation-related activities. This can be seen in the pervasive trend towards policy support for knowledge investments, both in regions that were flourishing technologically and in the lagging regions, where more than 40% of all Structural Funds are often devoted to innovation. The example of Europe clearly demonstrates the pervasive reliance in regional policy making on innovation as an instrument of regional growth: helping technologically leading regions to remain ahead and peripheral regions to catch up.

Yet, as this publication shows, this trend towards "homogeneity" in regional policy making, using comparative insights from good practices in different regions, will not ultimately advance the debate. The current imperative is to go back to the basics of regional innovation: to open, as this publication suggests, "the black box of regional innovation". What are the underlying factors determining spatial knowledge agglomeration? Economic geographers have noted the importance of access to large pools of qualified human capital, proximity to research centres, the attractiveness of urban environments and the presence of financial intermediaries. They have emphasised the importance of size, as in the case of large cities: "Bigger cities … attract more skilled workers, and there is some evidence suggesting that human capital accumulates more quickly in urban areas" (Glaeser and Resseger, 2009).[2] Yet it is also recognised that the main causal relation does not flow from location to innovation, but the other way around. When a pool of competences is created at a local or regional level, whatever the source (large companies, high-quality public research, etc.), other innovation actors decide to locate in the same place. In other words, at a certain threshold level of skilled production, agglomeration seems to attract mobile production factors, exploiting further localised and dynamic economies of scale. This process of attracting the most talented scientists and engineers, students, entrepreneurs, whether national or foreign, builds on geographically fixed factors. Specific local assets favour rents that are key in attracting mobile factors and serve as the cement to bind the ingredients together. In a certain sense, spatial agglomeration is favoured by the dynamic interplay of mobility and immobility.

It is this malleability of spatial knowledge agglomeration that has been the basis for the rapid growth and ubiquity of regional innovation policy. As this publication so clearly illustrates, it is difficult to overestimate the complexity of this process in divergent regional economic, geographic and institutional settings. Policies might focus on several areas: measures to strengthen research infrastructure; reforms in the organisation and autonomy of research institutions; changes in the social infrastructure for immigrants; or incentive structures for the launching and testing of new ideas. Variety is the name of the game: traditional wisdom on innovation, and a myopic view of the spatial dimension, are common traps in policy making.

But there is more. The advent of digital information and communication technologies has dramatically changed the international exchange of knowledge, with important implications for the internal and external organisation of research, the scope of national and international spillover effects, geographical advantages and, more broadly, the role of national and regional policy making. In theory, knowledge accumulation and diffusion need no longer be constrained by geography, opening a debate on whether the world is flat, or whether it consists of local knowledge peaks.

The importance to national processes of knowledge accumulation, of global communication, and of digital access to worldwide research output cannot be overestimated. Arguably, since the beginning of the new millennium, worldwide economic growth has been chiefly associated with an acceleration in the diffusion of technological change and worldwide access to knowledge, rather than by individual countries' domestic efforts to accumulate knowledge. As alluded to earlier, it is as if the growth convergence feature of public access to knowledge has become more significant. Such globalisation now includes the emergence of new players in new countries in knowledge production, as well as an increase in the circulation of knowledge and the mobility of skilled people at the international level. In this sense, globalisation refers to the multiplicity of linkages between companies and countries that make up the present globalised research and development (R&D) system. The globalisation of R&D has undoubtedly reduced the concentration of R&D and innovative capabilities amongst countries at the world level. At the same time, these trends have not really questioned the physical and spatial agglomeration of research activities within countries. Yet, taken together, these globalisation and agglomeration trends represent a challenge for public policy, exacerbating some of the classical tensions and trade-offs that policy makers have traditionally dealt with. To summarise some of these tensions:

- Research and innovation policies, whether at national or regional level, are still developed within administrative borders, while knowledge and investment flows are increasingly driven by firms and individuals at an international, global level. In many areas, administrative "taxpayer" jurisdictions no longer represent the appropriate forum for the design and implementation of such policies. As this publication suggests, the need to go beyond "localism" with respect to regional innovation policies is a broader challenge that also extends to national innovation policies.
- Many national and regional knowledge and innovation policies are rooted in the vision that the domestic or "local" efficiency/productivity problems are internal structural issues. However, such visions of competitiveness have become increasingly challenged by the way information and communications technology (ICT), as a general-purpose technology, has broken down the distinction between high- and low-tech sectors, nationally and internationally. The new policy challenge is how to deal with the increasing fragmentation of value chains and the increasing heterogeneity of required

knowledge inputs. This requires strong international co-operation in R&D and a stronger focus on the deployment of ICT-based technologies.

- Within countries or regional groupings such as Europe, the drive for excellence at the fundamental research level undoubtedly benefits from Europe's regional cultural diversity and autonomy. However, this often comes at the expense of the researcher's region of origin. For countries and regions that are in need of qualified human capital to make technological and economic progress, and that are in no position to match the working conditions and real income levels of the rich "excellent" regions, the flight of talent represents a serious problem. Surprisingly, given the importance of social cohesion in European economic integration, the regional implications of the new European and national research policies as regards research excellence have not been extensively discussed or studied. The regional social cohesion innovation policy focus emerged from a desire to assist less-favoured regions to increase their technological level, while the European Research Area dimension shifted gradually away from any "territorialisation" of research. In short, regional innovation policy could play a more central role in Europe in compensating for and offsetting regional trends towards the brain drain from Europe's less-favoured regions towards its centres of research.
- The financial and economic crisis is likely to increase some of the structural problems associated with globalisation and spatial knowledge agglomeration. To some extent, the impact of the fiscal crisis in many OECD countries will work counter to the ICT revolution of the last two decades. It is likely to bring back, at least in the short run, growth divergence features in knowledge accumulation, possibly reinforcing the existing regional and national disparities. This raises fundamental problems that extend beyond regional innovation policies. Yet, the trends and analyses presented here, describing further devolution of powers to sub-national entities, and the complexities of multi-level governance between regions, nations and supra-national authorities with respect to knowledge accumulation, will remain at the centre of the debate in the years to come.

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## Notes

1. It is worth noting how this differs from the US, where research and innovation is concentrated on the periphery in the Northeast and on the West Coast, with hot spots on the southern coast, on the border with Mexico and in the north near Canada.
2. Glaeser, E. and M. Resseger (2009), "The Complementarity between Cities and Skills", *National Bureau of Economic Research Working Paper 15103*, June, Cambridge, Massachusetts.

# Executive summary

In the wake of the 2008 financial and economic crisis, innovation is viewed as central in boosting job creation and economic growth in the quest to build stronger, cleaner, and fairer economies. This is reflected in major international agendas such as the OECD Innovation Strategy and the EU's Innovation Union. In the new push for innovation and competitiveness, regions have increasingly become relevant actors. Two policy trends contribute to the rising role of regions. First, the paradigm shift in regional development policies favours strategies based on the mobilisation of regional assets for growth, bringing innovation to the core of regional development agendas. Second, there is a growing recognition of the regional dimension in national innovation strategies in harnessing localised assets and improving policy impacts. The increased relevance of networks and connectivity for innovation also reinforces the importance of regional innovation systems. But regions are not countries and cannot simply replicate national policies at a regional scale.

What is needed to maximise the impact, and recognise the limits, of innovation policies **by**, **in** and **for** regions? This publication identifies several key areas for policy improvement.

**1. Acknowledge the diversity of regional economic and innovation profiles**. Regions and their innovation systems show varied development paths. Multiple types of regional innovation systems co-exist within the same country, including knowledge hubs, industrial production zones and regions that are not driven by science and technology (S&T). The landscape of technology-based innovation is not flat. Around 13% of OECD regions account for half of total OECD R&D investment. R&D and patenting are most concentrated in the top regions of knowledge-intensive OECD member countries, and those regions vary across different technology paradigms (green technologies, biotechnology and ICT, for example). New regions, from advanced countries and from countries that are catching up, are emerging as key players, reshaping the geographical landscape of innovation. Beyond technological leadership, several production systems mainly add value by investing in non-technological innovations, talent and creativity. Given the specificities and localised characteristics of non-S&T-driven systems, regional governments can play a significant role in supporting creative firms and a cultural environment that favours productivity, for example by offering targeted services for small and medium-sized enterprises and professionals. The empirical evidence on specialisation and innovation shows how varied regional innovation systems are, both within and between countries, and suggests that there cannot be a "one-size-fits-all" approach to regional innovation policies.

**2. Open the black box of regional innovation policies.** To identify the scale and scope for innovation policy in regions, three dimensions of the heterogeneity among regions need to be considered simultaneously: *i*) the **institutional context**, which concerns the room to manoeuvre for regional institutions as defined by the national governance framework and the degree of the devolution of powers. For example, in some countries, like Belgium, Germany and China, the sub-national share of public R&D and related spending can be 50% or higher; *ii*) the **regional innovation system**, which defines regional strengths and weaknesses for innovation and the nature of local and international relationships and networks; and *iii*) the **strategic choices** made by regions for supporting the transition towards an innovation-driven model of growth. The combination of these three dimensions increases the complexity for policy management at all levels of government, but is vital for achieving innovation policy goals.

**3. Enable regions to become agents of change.** Regional governments can play a determining role in identifying opportunities for transformation. Regions can act as mobilisers for driving diversification and identification of new frontiers. This search for new regional advantages requires participation of the private sector and civil society and usually benefits from complementarities with the broader national strategy. To become agents of change, regions need to adopt more sophisticated policy approaches. To this end, the following four steps are necessary:

- **Develop a vision and a strategic road map to encourage innovation.** What is needed is a shift toward outcome-driven policies based on a clear regional strategy for innovation. Regions face diverse challenges.

  ***Three strategic priorities for regions include:*** *i*) building on current advantages (science push, technology-led or a mix); *ii*) supporting socio-economic transformation (reconversion or new specialisations); and *iii*) catching up (through the creation of knowledge-based capabilities and upgrading of absorptive capacity). Clarification of the broad objectives to be achieved under an overarching vision, along with their translation into measurable goals, is therefore a first step.

  ***Regional innovation policies may suffer from a limited view of innovation.*** Science- and technology-based innovation covers only a fraction of the innovation potential that exists in different types of regions, according to their specific socio-economic profile. Regions need to invest in mapping the types of innovations that are most relevant for their vision, including those not necessarily measured by standard indicators. Advancing in the understanding of innovation could help regions identify strategies to mobilise innovation, science-based or not, for social goals (ageing, environment, health, etc.) and innovation in the public sector as well as job creation.

- **Design a smart policy mix** (asset-based and multi-sector). A smart policy mix aligned with the regional strategy would integrate several policy fields, vertically and horizontally. The "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy" revealed that many regional and national governments are using the "same" types of instruments, signalling the need to strengthen synergies across levels of government for increasing policy impact.

  ***A range of complementary instruments needs to target, to a different extent, knowledge creation, diffusion and exploitation***, combining traditional instruments (such as support to human capital and skills), emerging instruments (such as new generations of S&T parks, talent and creativity support) or experimental instruments (such as public procurement). The effectiveness of policies should take into account the systemic interaction of these different instruments combined.

- **Establish multi-level, open and networked governance structures**. The combination of decentralisation, bottom-up regional initiatives, and increasing attention to place-based dimensions in national policy has resulted in greater areas of interdependence in innovation policy.

  ***Well-designed tools for better vertical co-ordination across levels of government are required.*** Based on a diagnosis of the most pressing multi-level governance challenges, countries may identify and design adapted co-ordination tools. In fact, most countries report using four or more tools (e.g. dialogue, consultations, contracts, project co-financing, regional development agencies, territorial representatives, etc.). Tools that reinforce dialogue are reported as the most effective. Based on that dialogue, funding from higher levels may consider policy conditionalities associated with a smart policy mix in regions.

  ***Horizontal collaboration of public and private stakeholders*** is needed to take governance beyond government. Inter-departmental commissions, high-level strategic councils and regional innovation agencies are among the tools used to achieve a multi-actor and multi-sector approach.

  ***Targeting functional areas should be a major goal for policies.*** Administrative boundaries do not usually correspond to the spatial configuration of innovation and production networks. Policy approaches need to be "open", i.e. able to support innovation and take into account national and international cross-regional linkages.

- **Foster policy learning through better metrics, evaluation and experimentation.** Regions can play a determining role in improving the quality of policy-relevant evidence, and developing monitoring and analytical capacities to support evidence-based policies.

  ***New indicators are needed.*** Indicators should capture both R&D- and non-R&D-based innovation, map innovation networks in and across regions, and measure public and private innovation efforts. Understanding different regional profiles requires meaningful benchmarks and policy intelligence. Evaluations should focus not simply on inputs but on outcomes and changes in the behaviour of firms and other agents in the innovation system.

  ***Regions can be relevant laboratories for policy.*** The diversity of regional situations and the unpredictability of the innovation process generate the need for a certain degree of policy experimentation. Pragmatic experimentation, which can inform national policy, needs to be backed by outcome-oriented policy evaluation.

# Résumé

A la suite de la crise économique et financière de 2008, l'innovation est appelée à jouer un rôle majeur pour relancer la création d'emplois et la croissance économique, au sein d'économies plus fortes, plus vertes et plus équitables. Les agendas majeurs tels que la Stratégie de l'Innovation de l'OCDE ou l'Union de l'Innovation de l'Union européenne mettent cet enjeu en évidence. Dans ce contexte, les régions deviennent des acteurs pertinents. Deux tendances contribuent à donner un rôle accru aux régions en matière d'innovation. En premier lieu, le changement de paradigme au sein des politiques de développement régional donne priorité aux stratégies basées sur la mobilisation des atouts régionaux, conférant ainsi une place centrale à l'innovation. En second lieu, les agendas nationaux de l'innovation incluent une dimension territoriale accrue : le potentiel des régions est mis à contribution pour soutenir les performances nationales. L'innovation ouverte et en réseaux implique également une approche spatiale. Mais les régions ne peuvent déployer des politiques qui soient de simples répliques des politiques nationales.

Comment maximiser l'impact, et reconnaître les limites, des politiques d'innovation **par**, **dans** et **pour** les régions ? Cette publication identifie plusieurs voies d'amélioration de ces politiques.

**1. Reconnaître la diversité des profils des régions en matière de développement économique et d'innovation.** Les régions et leurs systèmes d'innovation connaissent des trajectoires de développement différentes. Pôles de connaissance, zones de production industrielles, régions dont le développement n'est pas lié à la science et à la technologie. Le paysage de l'innovation technologique n'est pas plat. Environ 13% des régions de l'OCDE concentrent plus de la moitié des investissements totaux en R&D. Les activités de R&D et la prise de brevets sont concentrées dans le segment supérieur des régions les plus intensives en création de connaissances, et la liste de ces régions diffère lorsque l'on considère différents domaines technologiques (technologies vertes, biotechnologies, technologies de l'information). De nouvelles régions, de régions avancées et de pays en rattrapage, apparaissent comme acteurs majeurs en matière d'innovation et changent le paysage en matière d'innovation. Au-delà du leadership technologique, certains systèmes de production créent de la valeur en investissant dans les innovations non-technologiques, les talents et la créativité. Compte tenu de la spécificité et des caractéristiques des systèmes non liés à la S&T, les gouvernements régionaux peuvent jouer un rôle significatif en soutenant les entreprises créatives, et en favorisant un environnement favorable, par exemple en offrant des services spécialisés aux PME et aux professionnels. Les données empiriques sur la spécialisation et l'innovation indiquent une grande variété de systèmes régionaux d'innovation, tant au sein d'un même pays qu'entre pays. Ces données remettent en cause une approche basée sur un modèle unique pour les politiques.

**2. Ouvrir la boîte noire des politiques régionales d'innovation.** Trois dimensions doivent être prises en compte simultanément pour identifier les contours d'une politique d'innovation pour les régions. La **perspective institutionnelle** concerne la marge de manœuvre des institutions régionales et le degré de dévolution des compétences tels que

définis par le contexte national. Dans certains pays, comme l'Allemagne, la Belgique ou la Chine, la partie des dépenses publiques de R&D d'origine sous-nationale égale ou excède 50%. Une seconde dimension est celle des **systèmes régionaux d'innovation**, qui comprend les atouts et faiblesses en matière d'innovation, et l'état des relations systémiques aux niveaux local et international. Le troisième élément est celui des **choix stratégiques** des régions en vue de leur transition vers des économies de la connaissance et de l'innovation. La **combinaison** de ces trois dimensions augmente la complexité des politiques à tous les niveaux de gouvernement, mais est cependant vitale pour atteindre les objectifs assignés aux politiques.

**3. Les régions comme agents de changement.** Les gouvernements régionaux peuvent jouer un rôle majeur pour identifier les opportunités de transformation des économies régionales. Ils peuvent mobiliser le potentiel de diversification et l'identification de nouvelles frontières. Cette recherche des nouveaux avantages régionaux doit être articulée avec l'agenda national. Elle nécessite la contribution et la collaboration d'un ensemble large d'agents privés et publics, au-delà des réseaux institutionnels traditionnels. Si elles veulent être des agents de changement, les autorités régionales doivent adopter des politiques plus sophistiquées. Quatre démarches importantes sont nécessaires:

- **Développer une vision et une démarche stratégique pour encourager l'innovation.** Pour gérer le changement, il est nécessaire d'évoluer vers des politiques tournées vers les résultats, basées sur une stratégie de développement régional orientée vers l'innovation. Les régions sont confrontées à des défis variés.

  ***Trois choix stratégiques s'offrent aux régions***: *i)* construire à partir des avantages actuels (basés sur la science, la technologie, ou les deux) ; *ii)* agir pour la transformation socio-économique (reconversion ou recherche de nouvelles spécialisations) ; et *iii)* rattrapage (amélioration du potentiel en matière de création de connaissances et de capacités d'absorption). Une première étape importante est dès lors de clarifier les grands enjeux dans le cadre d'une vision globale, et de transformer ceux-ci en objectifs mesurables.

  ***Les politiques régionales d'innovation peuvent souffrir d'une vue limitée de l'innovation.*** L'innovation basée sur la science et la technologie couvre seulement une fraction du potentiel dans les divers types de régions, en fonction de leur profil socio-économique. L'innovation peut aussi être présente sous des formes « cachées », qui ne sont pas mesurées par les indicateurs standards. Cette vue élargie de l'innovation doit inclure l'innovation pour les objectifs sociétaux (vieillissement, environnement, santé, etc.), à partir d'innovation basée sur la science ou non, et incluant notamment l'innovation dans le secteur public.

- **Définir un portefeuille « intelligent » de politiques** (basé sur les atouts et multi-sectoriel). Un portefeuille de politiques cohérent avec la stratégie régionale doit intégrer en son sein différents domaines de politiques. Le portefeuille d'instruments émane de plusieurs niveaux de gouvernement. L'enquête de l'OCDE sur la gouvernance multi-niveaux de la politique d'innovation révèle que les gouvernements régionaux et nationaux utilisent des instruments identiques (en apparence) et que donc, la recherche de synergies entre instruments des différents niveaux de gouvernements est de mise pour assurer l'impact des politiques.

  ***Un ensemble complémentaire d'instruments doit viser les fonctions de création, diffusion et absorption des connaissances,*** et combiner des instruments traditionnels (comme le support au capital humain), émergents (comme la nouvelle génération de parcs S&T ou le support à la créativité) et expérimentaux (comme les commandes publiques). Leur performance doit être évaluée individuellement et conjointement.

- **Établir des structures de gouvernance à multi-niveaux, ouvertes et en réseau.** La combinaison des phénomènes de décentralisation, des initiatives venant des régions, et l'attention croissante portée aux dimensions territoriales dans les politiques nationales, génèrent une dépendance mutuelle accrue entre niveaux de pouvoir en matière de politiaue d'innovation.

  ***Des mécanismes de coordination efficaces pour la coordination verticale entre niveaux de gouvernement doivent être développés.*** Les outils de coordination doivent être développés sur base d'un diagnostic des enjeux majeurs de gouvernance multi-niveaux. Dans l'enquête de l'OCDE, la plupart des pays déclarent utiliser une multiplicité de mécanismes (dialogue, consultation, contrats, co-financement de projets, agences de développement régional, représentants territoriaux). Les mécanismes qui renforcent le dialogue sont perçus comme les plus efficaces. Sur base de ce dialogue, le financeur au niveau supérieur peut définir des systèmes de conditionnalité à associer à un portefeuille « intelligent » de politiques.

  ***La collaboration horizontale entre acteurs publics et privés doit être renforcé.*** Les outils de cette coordination multi-acteurs et multi-secteurs sont notamment : les commissions inter-départementales, les conseils stratégiques de haut niveau, les agences régionales d'innovation.

  ***Les régions fonctionnelles doivent être visées par les politiques***. Les frontières administratives introduisent un biais du fait qu'elles sont en porte-à-faux avec l'existence de réseaux et de relations fonctionnelles au-delà de ces frontières. Les politiques doivent s'ouvrir aux relations nationales et internationales. Les réseaux en région (clusters, systèmes d'innovation) doivent être mis en lien avec les réseaux globaux.

- **Développer l'apprentissage en matière de politique à travers de meilleures techniques de mesure et d'évaluation, et grâce à l'expérimentation.** Les régions peuvent jouer un rôle majeur en améliorant la qualité des éléments empiriques à leur disposition, et en instaurant des mécanismes de suivi et d'évaluation performants.

  ***De nouveaux indicateurs doivent être développés.*** Ces indicateurs doivent : mesurer tant l'innovation liée à la R&D que l'innovation sans R&D ; donner une image des réseaux en région et au-delà ; et quantifier l'effort public et privé en matière de support à l'innovation. Pour comprendre les profils d'innovation différents des régions, il est nécessaire de disposer de données comparatives et de techniques d'analyse des politiques. Les évaluations doivent être plus robustes, et ne doivent pas seulement se pencher sur les entrants mais se centrer sur les résultats, les impacts et les changements de comportements des entreprises et agents du système d'innovation.

  ***Les régions peuvent être de bons laboratoires pour la politique d'innovation.*** La diversité des situations régionales et le caractère non prévisible du processus d'innovation, génèrent un besoin d'expérimentation des politiques. Des expérimentations pragmatiques, qui peuvent informer les politiques nationales, doivent être assorties d'évaluations de politiques centrées sur les résultats.

# Part I

# Strategies, policies and governance

# Part I

## *Chapter 1*

## Why regions matter for innovation policy today

*OECD member countries identify innovation as the major driver in new models of growth, which aim to increase productivity and raise standards of living. Regions are key actors in this context but their role in innovation is complex. Regions cannot simply replicate national policies. Empirical evidence provided in this chapter shows that:* i) *regional innovation systems follow varied development paths;* ii) *heterogeneity can sometimes be more pronounced within countries than between countries;* iii) *while R&D and patenting are mostly concentrated in key regions in top OECD innovative countries, new regions are emerging as knowledge hubs;* iv) *regional collaboration and networks are becoming increasingly relevant for innovation;* v) *firms carry out both technological innovations (new products and processes) and non-technological innovations (such as new business models and organisational methods); and* vi) *design and creative industries are strongly shaped by regional factors and are vital for regional competitiveness. However, better metrics are needed to account for innovation processes in such industries.*

## Introduction

Both the OECD and the European Union (EU) have recently emphasised the crucial role of innovation and the importance of appropriate institutions, policies and governance to support it (OECD, 2010a; European Commission, 2009a). The capacity to introduce new products, processes, services, business models and organisational methods in firms has been recognised as a major source of productivity and long-term output growth. Technology and innovation are typically characterised by increasing returns to knowledge adoption and diffusion. And knowledge has characteristics as both a private as well as public good. It is the differences in knowledge, accumulated learning processes and technical competences (either embodied, in a skilled labour force, in firms or in collective systems, or disembodied, codified in patents, or acquired through external R&D services and technical assistance), that explain the major differences in growth patterns and living standards of different countries and regions.

The 2008 financial and economic crisis reinforced the consensus that innovation, as well as investment in the capacity to innovate, is central for recovery and other social goals. There is greater recognition of the need to move towards new, more inclusive and environmentally sustainable models of growth. It is not only the rate of technical change (i.e. intensifying the introduction of new technologies and technical devices) but also its direction (in applications, uses and solutions) that can help to address societal challenges.

Innovation today is called upon not only to contribute to productivity growth, but to raise the quality and quantity of jobs and improve standards of living. This is not an easy task. Changes in business practices and consumption modes, rising commitment from the business sector and better policies are needed. In some cases, better policies will mean mobilising more resources. In others, priorities must be reformulated and governance improved to increase policy effectiveness and support synergies between different types of interventions. In this context, the regional perspective plays a decisive role.

The new generation of innovation policies will need to supplement the traditional emphasis on inputs (such as R&D as a share of GDP policy targets) with broader kinds of intervention. The more comprehensive policy approach considers supporting human resources and talent, creating demand for innovative products through public procurement schemes, offering advanced innovation services for SMEs, and promoting novel forms of support for innovation networks and collaborative arrangements. Such new areas in national policies have been vital in the agendas of regional governments that have successfully mobilised innovation and production capacities for regional development. Interaction between regional and national strategies is crucial.

There are no recipes for knowledge and innovation diffusion. Differences in knowledge absorption, creation and diffusion capacities across regional innovation systems tend to persist over time, both between and within countries. Experience shows that there is room for virtuous catching up, or leap-frogging, but that those processes are usually shaped by a series of complementary factors and need to be supported by smart policies. The costs of not favouring the transition to a socially and environmentally sustainable growth paradigm are too high. The new innovation agenda must be inclusive, and regions are key players in this endeavour, which demands effective co-operation between the different levels of government.

## 1.1. A double policy paradigm shift

The increasing importance of regions in innovation policy can be explained by two concurrent phenomena: *i*) the inclusion of regions and their specific assets in national innovation policy; and *ii*) the paradigm shift in regional development policy.

Many OECD regions are formulating regional innovation strategies to increase their economic competitiveness, with a tradition of institutions supporting innovation for regional growth. For some countries, like the new member countries of the EU, this is a new trend based on increased democratisation, devolution and decentralisation. For others, such as Canada, Germany, Spain and the United States, there has been long-standing regional action in innovation.

In EU countries, the availability of Structural Funds has helped regions mobilise their assets for knowledge-based growth. Innovation has become one of the major pillars of EU regional development policy. From 1989-1993, approximately 4% of regional policy funds were devoted to innovation (2 out of 50 billion). The share of broadly defined innovation-related spending for the period 2007-2013 is projected to be approximately 25%, totalling around EUR 86 billion. Nevertheless, persistent knowledge, technology and innovation gaps between and within countries demand improved and better targeted policies.

### *The regional dimension is gaining recognition in national innovation strategies*

Many OECD member countries have advanced in their capacity to incorporate the regional dimension in innovation policies. This often reflects the acknowledgement by national governments of the need to better co-ordinate their actions with the policies implemented by regional governments to increase their effectiveness. Three major factors can help explain the increased recognition of the regional dimension in national innovation strategies.

**The increasing importance of innovation for social well-being.** Governments have come to recognise that innovation needs to support social and environmental sustainability. This is evidenced, for example, in the current OECD emphasis on green growth, which highlights that environmental sustainability and economic growth are mutually reinforcing and interdependent strategies, not an either/or policy trade-off. In such areas, regional authorities have both the room and the mandate to act. This new and broader objective for innovation policy calls for more sophisticated policy approaches and better articulated governance, necessitating policy experimentation. Some regions have pioneered supporting innovation to improve regional development taking into account economic, social and environmental externalities, as in the cases of local green public procurement and regulations or innovations in services for elderly people.

**A clearer understanding by policy makers of the dynamics of innovation.** OECD member countries now have extensive experience in designing and implementing innovation policies. Policies increasingly recognise that innovation is: *i*) a systemic phenomenon influenced by scientific and technological forces, as well as by demand and market incentives; and *ii*) shaped by learning and business practices, which are in turn influenced by, among other factors, the legal and regulatory framework.

Policies also increasingly reflect the fact that, at the firm level, innovation requires multiple pre-requisite conditions. They include, for example, trained personnel, networks, a favourable regulatory and institutional environment, a high degree of entrepreneurship and creativity, risk-friendly funding sources, and innovation-oriented business practices. This broader approach to innovation policy calls for greater articulation between national and regional policy instruments.

In addition, behavioural differences of innovation agents (due to size, sector, technology intensity, etc.) create the need for complementarity between sectoral and place-based instruments. Sectoral instruments, such as incentives for R&D, are often managed at the national level. Cross-sectoral and place-based instruments, such as cluster policies, delivery of innovation services, etc., are often delivered at the sub-national level. This suggests a variety of possible multi-level governance configurations for successful innovation support. It also calls for a differentiated approach to address the specificities of local and regional innovation systems.

**The rising demand for policy accountability and monitoring of outcomes.** Governments are concerned with the need to increase policy accountability, and show the impact of their policies on citizen well-being. Countries need to advance in their capacity to evaluate the impact of innovation policy. First, research and innovation are characterised by a high degree of uncertainty. A simple cost-benefit analysis made on input/output ratios is not suitable for taking into account the value added of innovation-allocated expenditures. Second, there are complementarities of policy investments. It is very difficult to observe direct relationships between a single public investment and the innovation output, as many policies have a facilitator goal, or provide only indirect support to innovators. Third, the majority of innovation-related actions produce results in the medium and long term, and require sustained investments to be effective. Creating institutional capacity for policy accountability, along with the monitoring of outcomes (as opposed to simply measuring the immediate impact of outputs, like how much public money was spent on R&D tax credits) is a costly, but needed exercise. Since innovation outcomes are the result of complex dynamic interactions between many actors over time, collaboration across the different levels of governments is essential for creating performance accountability mechanisms.

### *The new regional policy: mobilising knowledge, assets and capacity for growth*

In its origins, regional development policy usually targeted marginalised areas in order to mitigate the undesired consequences of agglomeration-based, market-led development. Based on the implicit assumption that modern capitalist development required free markets and a market-based selection of winners, the concentration of economic activities in islands of technological excellence was seen as a precondition for technology-based growth. Regional development policy was therefore essentially resource transfers to lagging regions from wealthier regions. The ultimate policy objective was to compensate for regional disparities in employment and other aspects of economic performance in the poorer regions.

The disappointing results of several large transfers of funds to marginalised regions called for a change in policy. Since the late 1990s, the institutional school (Amin and Hausner, 2007) has defended a new vision for regional policy, conceived as a set of cross-sectoral initiatives supporting a more balanced development pattern on the basis of existing local strengths and assets. This new paradigm has been progressively adopted, and regional development policy now increasingly aims to create the conditions for endogenous growth in each territory on the basis of local assets, capabilities and economic potentialities (OECD, 2010a).

By creating the conditions and the institutions to enhance productivity and well-being, regional development policies contribute to aggregate national performance. Regions are called to identify and exploit their own development potential, capitalising on their assets and clearing bottlenecks.

This paradigm shift, in vision but not always in practice, brings innovation to the core of the regional development agenda. A proliferation of documents and flagship initiatives does not guarantee a real policy shift. The rising importance of innovation as a regional development driver should also be measured in terms of regional public accounts. Unfortunately, few countries collect detailed data on regional expenditures on innovation, and standards have not been established for comparing such data across countries. Procedures are needed to track regional investments on innovation (and this clearly goes beyond R&D expenditures). Regional expenditures on certain budget items not related to innovation can also serve as multipliers of national expenditures that could usefully be measured (policies for attracting skilled migrants, for example).

The scale for policy action depends on the element of the innovation process targeted as well as institutional and governance arrangements in each country and inter-regional differences. This heterogeneity is manifest in the production structure, historical and cultural patterns, institutional capacity, knowledge absorption, and degree of connectivity of regions, among other factors. The interaction of these dimensions creates a complex setting for designing and implementing policies, which preclude the adoption of the "one-size-fits-all" approach to policy (see Chapter 2).

## 1.2. An evolving innovation scenario

Three major trends are reshaping innovation and have encouraged regions to take a more active role: *i*) increased globalisation; *ii*) the rising demand for innovation to address social and environmental challenges; and *iii*) the increasing importance of networks for innovation.

### *Increased globalisation*

Globalisation is reshaping the innovation process worldwide, challenging countries, regions and firms (OECD, 2010a). The technology-based innovation landscape is still dominated by a limited number of OECD member countries such as Germany, Japan, the United States and several Nordic countries. But new players are emerging, such as Korea and some Eastern European countries, along with rising global powers such as Brazil, India and China.

Globalisation has a dual effect on regions. On the one hand, it increases the need for regional and local action to identify possible endogenous sources of growth and it challenges regions to retain production capacities and talents locally. On the other hand, it opens opportunities for organising research and production across borders, favouring the mobility of talent and increasing the opportunities for international collaboration. Globalisation has a differentiated impact across regions within the same country. Strong knowledge- and technology-intensive regions may benefit from greater opportunities for networking and exchange with their foreign counterparts, so that they can play a leading role globally. In less knowledge-intensive regions and peripheral areas, the knowledge or technological gap can increase if appropriate policies are not put in place.

Globalisation also modifies the relevant boundaries for innovation. International and cross-regional flows of investment, production resources and talent, may shift the balance of national and regional resources towards particular places. The governance of innovation policy will need to be reworked to clarify the roles of different institutional administrative areas with the relevant spatial scale for innovation. An example is the relationship of regional innovation policies with urban policies. In the global competition to attract and retain talent and investment, cities are no longer competing with their peers within national boundaries, but with their counterparts overseas. Innovation policies need to take into account the impact of urban policies on attractiveness for innovation activities.

### *Societal and environmental challenges*

In recent years, both the European Commission and the OECD have recognised the need to mobilise innovation not only as a means to boost competitiveness, but also to foster societies' well-being (European Commission, 2009a; OECD, 2010a). The EC defines these broader challenges as:

> …those societal problems that cannot be solved in reasonable time and/or with acceptable social conditions, without a strong and, in the European case, co-ordinated input requiring both technological and non-technological innovation, and also, but not necessarily always, advances in scientific understanding. Important examples are, and without any attempt to cover all aspects: climate change; sustainable energy and environment; sustainable city life (mobility, congestion, green car, urban quality of life); ageing of population; poverty (European Commission, 2009a:71).

Addressing social challenges through innovation requires active policies to create incentives and conditions so that public and private agents commit to investing in and providing solutions for the common good. Regional governments need to find a way to support local activities that increase the well-being of the regional community without being trapped in a local bias. A co-ordinated effort is needed, but institutional responsibility may be fragmented across different levels of government. For example, a green growth strategy requires co-ordinated efforts both on supply (new technologies, new energies, new patterns of production and trade) and demand (patterns of consumption and use). Certain regions are likely only to play a role on the supply side, while virtually all regions are called to play a role on the demand side. Regions can actively intervene by supporting the switch in demand towards sustainable goods and services, and by establishing standards and regulating markets (European Commission, 2009a; Edler and Gheorghiou, 2007).

### *The increasing importance of networked innovation*

Information and communication technologies (ICT), biotechnology and green technologies rely on incremental innovation, and thus need to combine knowledge from multiple sources. This calls for a broader approach to innovation, which matches research-based and high-tech innovation, with new organisational methods, new forms of service delivery and innovative, non-technological solutions to current challenges.

Collaboration and networks are increasingly important for innovation. However, open innovation is not a new trend. Firms have always turned to external sources for ideas to innovate and to share responsibilities in production. What is new today is the speed with which connectivity can take place, the increasing number of potential partners, and the extended geographical distribution of potential partners. Firms are experimenting with new ways of organising production, trying to capture the opportunities offered by the new technological paradigms and globalisation that challenge the existing spatial organisation of innovation.

This creates opportunities for regions. Thanks to their expert knowledge and proximity to local actors, regional authorities can play the role of facilitator and broker to ensure fluidity of relationships and can invest in supporting collaboration between actors within and outside the region. Maintaining existing and ensuring new linkages to wider networks is also a relevant task for local and regional administrations. Effective policies need to encourage "regional buzz" and access to "global pipelines" (see Chapter 2, Bathelt *et al.*, 2002).

## 1.3. Innovation and regions: evidence from the OECD

The OECD Innovation Strategy recently drew attention to the need to advance in the measurement of innovation (see Box 1.1). This provides a relevant framework for the analysis of innovation in regions.

The EU and the OECD have carried out extensive efforts to measure and analyse regional innovation. Several advances have been made, but much has yet to be done to improve the capacity to measure innovation efforts beyond R&D and technology-led innovation. The following section illustrates some stylised facts of innovation and regions in OECD member countries, mainly on the basis of the *OECD Regional Database*. The section focuses on seven major topics: innovation and growth, the heterogeneity of regional innovation systems between and within countries, human capital, economic specialisation, R&D efforts, trends in patent intensity and non-technological innovations.

### Box 1.1. **The OECD Innovation Strategy: selected key findings from *Measuring Innovation: A New Perspective***

The *OECD Oslo Manual* identifies four types of innovation: product, process, marketing and organisational.

| Type of innovation | Definition |
|---|---|
| Product innovation | A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness and other functional characteristics. |
| Process innovation | A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. |
| Marketing innovation | Significant changes in product design or packaging, product placement, product promotion or pricing. |
| Organisational innovation | A new organisational method in the firm's business practices, workplace organisation or external relations. |
| Degree of novelty | Each type of innovation can be new to the firm/institution, to the market/sector or the world. |

### Box 1.1. **The OECD Innovation Strategy: selected key findings from *Measuring Innovation: A New Perspective*** *(cont'd)*

The OECD Innovation Strategy capitalises on the experience in measuring innovation in OECD member countries and highlights a series of key issues for improving existing metrics:

- **Intangible assets:** innovation results from a range of complementary assets beyond R&D, such as software, human capital and new organisational structures. Investments in these intangible assets is rising and overtaking investment in physical capital (machinery and equipment) in Finland, Sweden and the United States for example.
- **Innovation goes beyond R&D:** innovation embraces a range of complementary assets that go beyond R&D, such as software, human capital and new organisational structures. Firms may introduce new products on the market without engaging in R&D. For example, in Australia and Norway the propensity to introduce new-to-market product innovation is similar whether or not the firm performs R&D.
- **Mixed modes of innovation:** firm-level innovation data reveal complementary strategies. Terms such as "technological" or "non-technological" innovation are simplifications and to some extent misleading. Most innovative firms introduce both product and process innovations, as well as marketing or organisational innovations. This is true for firms in both manufacturing and services. There are, of course, differences by sector and firm size. For instance, a larger share of firms in services than in manufacturing introduce only marketing or organisational innovation.
- **Collaboration and networks are essential:** firms that collaborate on innovation spend more on innovation than those that do not. This suggests that collaboration is likely to be undertaken to extend the scope of a project or to complement firms' competences more than to save on costs. In most countries, collaboration with foreign partners is at least as important as domestic co-operation. Collaboration is used in innovation processes whether firms perform a lot of R&D, a little R&D or no R&D at all. In this respect, policies that stimulate collaboration and network initiatives will have an impact on the entire spectrum of innovative firms. Increasing collaboration is also observed in the sciences. Production of scientific knowledge is increasingly shifting from individuals to groups, from single to multiple institutions, and from national to international arenas.
- **Convergence of scientific fields and multi-disciplinary/interdisciplinary research:** using "science maps", there is evidence that increasingly, innovations are achieved through the convergence of scientific fields and technologies. For example, nanoscience research has arisen from the interaction of physics and chemistry and is interdisciplinary in character. Environmental research is one example of multi-disciplinary research. This requires creating spaces for interaction and cross-fertilisation of different knowledge domains.

*Source*: OECD (2010), *Measuring Innovation: A New Perspective*, OECD Publishing, Paris, doi: 10.1787/9789264059474-en; OECD (1997), *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data: Oslo Manual,* OECD Publishing, Paris, doi: 10.1787/9789264192263-en.

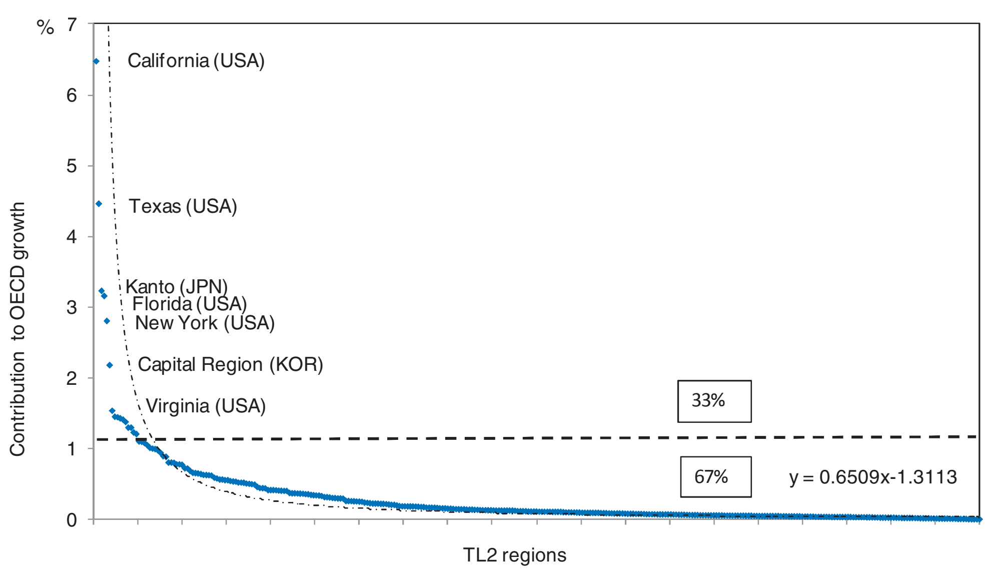
## *Growth, regional development and innovation*

Disparity in per capita income within and between OECD regions is a widespread and persistent phenomenon (OECD, 2008). This suggests that there are structural features and cumulative factors that determine how regions grow and how income is distributed within their territory. Regions can grow more and display better standards of living for several reasons. They may host global technology and innovation hubs, wealthy manufacturing centres, or be rich in natural resources. The intensity and quality of linkages with bordering (or cross-border) regions and other specific local dynamic characteristics also shape growth patterns. Patterns of generation and diffusion of knowledge and production structure specialisation play a determinant role among those structural features.

The distribution of regional contributions to aggregate growth follows an asymmetric profile. Figure 1.1 confirms this skewed distribution, showing the top 4% of OECD TL2 regions (14 in number) accounting for 33% of aggregate OECD growth over the period 1995-2005. The top contributing regions are California (6.5%), Texas (4.5%), Kanto (3.2%) and Florida (3.16%). The other 96% of regions contributed to 67% of growth, each making a small contribution, but having a large aggregate impact. A growth agenda needs to consider how to mobilise and increase growth in this tranche, with respect to physical, human and geographical endowments.

The question is to what extent innovation can help realise this growth potential. Investing in human capital, infrastructure and in developing knowledge-based production systems appear to be vital for supporting endogenous growth. As Garcilazo and Oliveira Martins (2010) show, it is possible to describe the differences in innovation performance of OECD regions dividing them according to their contribution to aggregate growth. Descriptive statistics (Table 1.1) show that the 27 "big hub" regions outperform other regions, especially with respect to innovation indicators such as business expenditures on R&D, patenting and collaborative arrangements for innovation.

Figure 1.1. **Contributions to OECD GDP growth, TL2 regions, 1995-2005**




Notes: The next largest contributions come from: London (GBR), Georgia, North Carolina and Illinois (USA), Ontario (CAN), Ile-de-France (FRA) and Lombardy (ITA).

A power law is a special type of mathematical relationship between two quantities. If one quantity is a frequency of an event, and the other is the size of the event, the relationship has a power law distribution when the frequency of the event decreases at a greater rate than the size increases. Defining the distribution of regions as the frequency of an event and their contribution to overall GDP growth as the size of an event, we obtain a close, if not perfect, fit with a power law distribution. The dashed line estimates the coefficient of power laws using a fitted line specified as non-linear power law for TL2 regions.

*Source*: Garcilazo and Oliveira Martins (2010), calculations using data from the *OECD Regional Database*.

Table 1.1. **Descriptive statistics for 27 big hubs and other regions**

Data for 2008 or latest year available

| Indicators | 27 big hub regions | | Other regions | |
|---|---|---|---|---|
| | Value | Number of observations | Value | Number of observations |
| Motorways density | 0.82 | 27 | 0.78 | 272 |
| Primary educational attainment (% of labour force) | 16% | 25 | 28% | 266 |
| Tertiary attainment (% of labour force) | 30% | 25 | 24% | 266 |
| Employment rate | 72% | 27 | 64% | 297 |
| Unemployment rate | 5% | 27 | 8% | 303 |
| Long-term unemployment rate | 2% | 8 | 4% | 220 |
| Youth unemployment rate | 12% | 26 | 16% | 254 |
| Participation rate | 76% | 27 | 69% | 303 |
| PCT patent applications per million inhabitants | 185.41 | 27 | 72.04 | 279 |
| Share of co-patents in PCT | 0.69 | 27 | 0.61 | 279 |
| ln R&D expenditure total (PPP) | 9.19 | 23 | 6.23 | 215 |
| R&D expenditure by the business sector (as % of GDP) | 1.69% | 25 | 0.79% | 225 |
| R&D expenditure by the government sector (as % of GDP) | 0.32% | 25 | 0.26% | 220 |
| R&D expenditure total (as % of GDP) | 2.62% | 25 | 1.43% | 225 |
| High- and medium-high-technology manufacturing (as % of total employment) | 5% | 25 | 6% | 238 |
| Knowledge-intensive services (as % of total employment) | 44% | 25 | 31% | 250 |
| Co-inventions within region | 6 457 | 27 | 535 | 286 |
| Co-inventions within country, other regions | 1 852 | 27 | 212 | 286 |
| Co-inventions with foreign regions | 636 | 27 | 109 | 286 |
| PISA mathematics score | 516 | 27 | 465 | 308 |
| PISA reading score | 518 | 27 | 469 | 308 |

Notes: The selection of the 27 regions follow a simple rule, by splitting the sample of regions in Figure 1.1 at the point where the estimated curve ($y=0.65.x^{-(1.511)}$) meets the 45° line.

*Source*: Garcilazo and Oliveira Martins (2010), calculations using data from the *OECD Regional Database*.

## *Regional innovation systems: different regional development paths*

Even though growth performance of leading regions is highly associated with investments in R&D and technological development, evidence also shows that there are multiple development patterns and growth models for success. The concept of regional innovation systems (RIS) helps to describe these differences and to highlight the variety of these patterns and models. The RIS concept was introduced into the policy debate in the late 1990s as a regional interpretation of national innovation systems (NIS) (Cooke, 1992; Cooke and Morgan, 1998; European Commission, 1998). The NIS approach has been largely adopted in policy making (Freeman, 1987; Nelson, 1993; OECD, 1999).

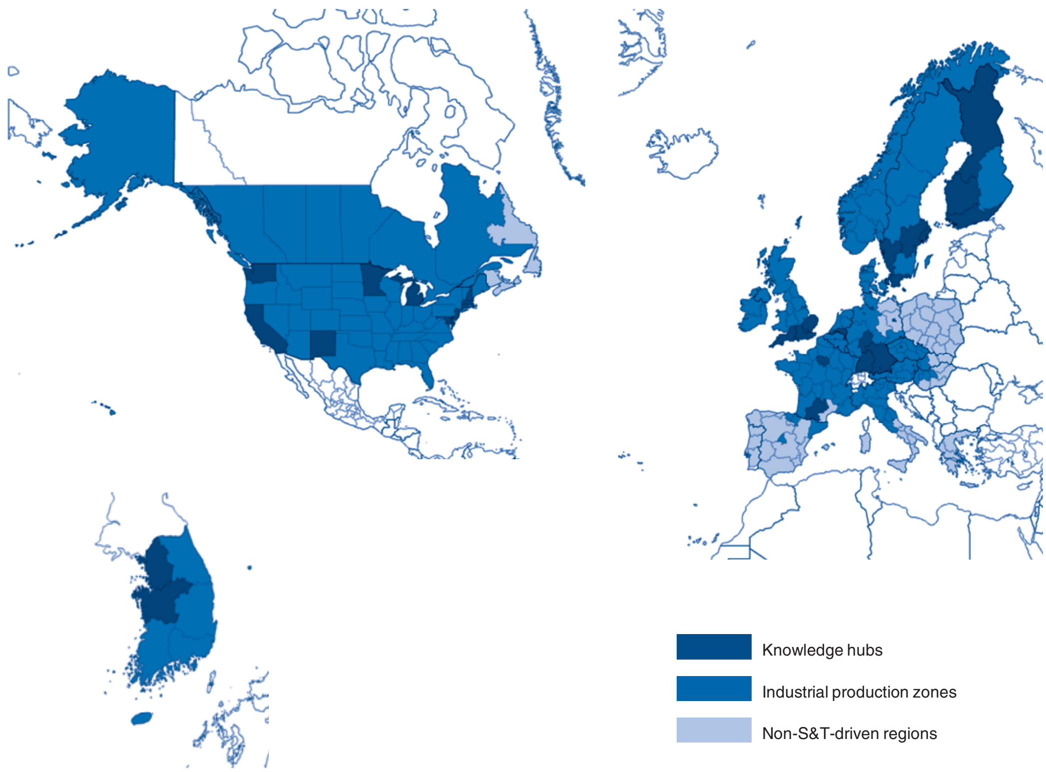
The RIS framework, following the NIS approach, defines innovation as a cumulative and non-linear systemic process. It results from the formal and informal, voluntary and involuntary interactions between different agents operating in the innovation system. Firms are the main repositories of technical knowledge and know-how and the primary agents in the search for innovation. However, the innovative performance of a given system (local, regional or national) also depends on the performance of other agents (such as universities and research centres), on framework conditions (such as standards and regulations), and on forces shaping the demand side. Moreover, the intensity and quality of interactions between those agents is a key determinant of the performance of the system.

The literature on RIS and heterogeneity between regions is rich. Some studies focus on regional diversity in terms of production structure specialisation. Others, such as the literature on "innovative *milieux*", analyse the institutional dimension, looking at density of intra-regional institutional relations as a key characteristic of each RIS.

On the quantitative side, a series of studies focus on the elaboration of regional typologies. Regions can be classified according to their growth performance (OECD, 2008), or by a composite indicator, as in the EU Regional Innovation Scoreboard (European Commission, 2009b). Other studies develop typologies on the basis of several indicators, using cluster analysis techniques to highlight the diversity in regional innovation structures and innovation potential. A recent EU study identified 7 types of regions within Europe, based on 21 variables capturing the 5 following dimensions: employment, human resources, innovation activity, technology and economy (Wintjes and Hollanders, 2010). These variables have in turn been aggregated into broad factors capturing accessibility to knowledge, knowledge diffusion and absorption. Regions with, on average, low scores for the three factors (skilled industrial eastern EU and traditional southern) have on average low GDP per capita. Regions with generally high scores on the three factors (metropolitan knowledge-intensive services and high-tech regions) show the highest GDP levels per capita. This illustrates how regions need to achieve a balanced development pattern combining knowledge availability with diffusion and absorption (see Box 1.A1.1).

Most of the available studies focus on the EU. Figure 1.2 shows the results of an analysis based on 12 regional variables for 23 OECD member countries and covering 240 regions. The sample accounts for around 78% of OECD GDP and 71% of population. On the basis of regional performance, labour market and technology-based innovation indicators, eight regional groupings have been identified. These groups fall into three main categories: **Knowledge hubs, Industrial production zones** and **Non-S&T-driven regions**. The three categories display some common traits in terms of their specialisation, but each faces specific policy challenges (see Table 1.2. for a description of the groups and discussion in Chapter 2 of the categorisation of regions and different policy challenges).

Figure 1.2. **Categorisation of OECD regions**




Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source*: Ajmone, G. and K. Maguire (forthcoming), *Categorisation of OECD Regions Using Innovation-Related Variables*, Regional Development Working Papers, OECD Publishing, Paris.

The **Knowledge hubs** account for around 30% of the total sample GDP 25% of the population. Within this category, two groups stand out. The **Knowledge-intensive city/capital districts** have by far the highest average level of GDP per capita, due in part to the under-bounded size of these regions which benefit from inward commuting from neighboring regions. **Knowledge and technology hubs** are found in top knowledge-intensive countries (mainly located in the United States, Finland, Germany, Sweden and the United Kingdom). They have by far the highest R&D and patenting intensity of any group.

**Industrial production zones** cover around 60% the sample GDP and population. Four distinct groups are observed given their productive structure and intensity of technology-related indicators. To stay competitive, they may need to diversify or restructure their economies.

- The group **US states with average S&T performance** covers 38 states, all but one that is not classified in the knowledge hub category. These US states are distinctive from other Industrial production zone regions. It would appear that national effects contribute to a higher average for GDP per capita, share of manufacturing employment in high- and medium-high-tech sectors and share of services that are knowledge-intensive services (KIS). However, this group of US states has on average a significantly lower share of the labour force with tertiary education than several other groups.

- The group **service and natural resource regions in knowledge-intensive countries** includes 28 OECD regions mainly from Canada and countries in the northern half of Europe (from the Netherlands and Denmark to Norway, Finland and Sweden). These regions account for a relatively small share of the overall GDP and population of regions analysed. They are often second-tier regions in knowledge-intensive countries. They appear to derive wealth to a lesser extent from high- and medium-high-technology manufacturing than other Industrial production zones. Rather, wealth is likely derived in larger part from services and natural resources supported by a well-educated workforce.
- **Medium-tech manufacturing and service providers** includes 49 OECD regions. They are generally lesser performing regions in knowledge-intensive countries or leading regions in middle income countries. These regions represent over one-fifth of the sample GDP and population. They have a generally well-educated labour force and strengths in manufacturing.
- **Traditional manufacturing regions,** 30 in total, are mainly from Austria, the Czech Republic and Italy. This group is distinctive for having the highest share of employment of any group in manufacturing and the lowest share of the labour force with tertiary education.

The third category, the **Non-S&T-driven regions,** accounts for only 14% of the sample population and an even smaller 8% of total GDP. These regions have very low intensity in patenting and R&D, the latter being driven mainly by the public sector and not firms. The group **Structural inertia or de-industrialising regions** includes 38 regions. They are generally lesser performing regions relative to national averages in Southern and Eastern Europe (Spain, Hungary, Italy, Poland and Slovak Republic) as well as Canada, Germany and France. The group has on average the highest rates of unemployment and generally low values across the board. The 19 **Primary-sector-intensive regions** come from Greece, Hungary, Poland and Portugal. These regions often contain notable rural areas and have a notably higher share of employment in primary sector activities. They have significantly lower wealth levels and values on technology-related indicators.

Table 1.2. **Categorisation of OECD regions: knowledge hubs, industrial production zones and non-S&T-driven regions**

| Group type | Main characteristics | Population (% of sample) | GDP (% of sample) | Average GDP per capita Constant USD 2000 |
|---|---|---|---|---|
| **Knowledge hubs** | | **25.2** | **29.6** | |
| Knowledge-intensive city/capital districts<br><br>(9 regions: Vienna, Brussels, Prague, Berlin, Bremen, Hamburg, London, DC, Korea Capital Region) | These densely populated capital or city districts have high R&D and patenting intensity. The high share of services in knowledge-intensive sectors takes advantage of the highly educated workforce. Due in part to small geographic size and commuting, these regions have on average very high GDP per capita. They also have a relatively high unemployment rate. | 4.9 | 5.1 | 51 065 |
| Knowledge and technology hubs<br><br>(29 regions: 3 Germany, 1 Denmark, 3 Finland, 2 France (including Ile-de-France), 1 Korea, 1 Netherlands, 4 Sweden (including Stockholm), 3 UK, 11 US (including California, Massachusetts, Michigan, New Jersey) | These are the top knowledge and technology regions in the OECD. They have, by far, the highest average levels of R&D and patenting intensity, as well as the share of R&D conducted by business. The industrial structure includes a significant share of manufacturing in high-technology sectors. | 20.3 | 24.5 | 35 729 |
| **Industrial production zones** | | **60.4** | **62.1** | |
| US states with average S&T performance<br><br>(38 regions: all US) | This group covers 38 US states, generally those which are not Knowledge hubs. They are distinctive relative to regions in other OECD countries given their high wealth levels and above average R&D and patenting intensity. They also have a generally strong share of manufacturing in high- and medium-high-technology sectors, and services in knowledge-intensive sectors. They have a notably less educated workforce than most other Industrial production zone groups. They are also less densely populated than other OECD regions, due in part to the larger spatial scale of US states relative to regions in other countries. | 25.3 | 30.2 | 35 791 |
| Service and natural resource regions in knowledge-intensive countries<br><br>(28 regions: 4 Canada, 4 Denmark, 1 Finland, 2 Korea, 1 Luxembourg, 3 Netherlands, 7 Norway (including Oslo), 4 Sweden, 1 Slovak Republic (Bratislava region), 1 UK) | These regions are often a second-tier in knowledge-intensive countries. They are generally of small geographic scale and/or less densely populated but with a highly educated labour force. They may derive wealth in part from the high share of employment in knowledge-intensive services, or natural resources, in addition to the more limited manufacturing which is in sectors of lower technology level than other Industrial production zones. | 5.1 | 5.6 | 33 187 |
| Medium-tech manufacturing and service providers<br><br>(49 regions: 2 Belgium, 2 Canada, 7 Germany, 4 Spain (Madrid, Catalonia, Basque Country and Navarre), 18 France, 1 Greece, 1 Hungary, 2 Ireland, 2 Italy, 2 Korea, 1 Portugal (Lisbon), 7 UK) | These are industrial production regions (manufacturing and services) and some capital regions of middle income countries. While not the global high-technology hubs, they do have a strong medium-low- and medium-high -technology industrial base. They also have relatively high knowledge absorptive capacities, including a significant share of the labour force with tertiary education. | 23.1 | 20.1 | 25 565 |
| Traditional manufacturing regions<br><br>(30 regions: 8 Austria, 7 Czech Republic, 2 Hungary, 10 Italy, 1 Korea, 1 Slovak Republic, 1 US) | These regions have the highest share of employment in manufacturing, generally in medium-low- and low-technology (traditional) sectors. Business accounts for the bulk of R&D investment. This group is also distinctive for the relatively lower-skilled labour force (lowest share with tertiary education of any group). | 7.0 | 6.2 | 25 686 |

Table 1.2. **Categorisation of OECD regions: knowledge hubs, industrial production zones and non-S&T-driven regions** *(cont'd)*

| Cluster type | Main characteristics | Population | GDP | Average GDP per capita |
|---|---|---|---|---|
| | | (% of sample) | | Constant USD 2000 |
| **Non-S&T-driven regions** | | **14.4** | **8.3** | |
| Structural inertia or de-industrialising regions<br><br>(38 regions: 4 Canada, 3 Germany, 13 Spain, 1 France, 3 Hungary, 8 Italy, 4 Poland, 2 Slovak Republic) | These regions with persistent "underdevelopment" traps face a process of de-industrialisation or experience structural inertia. They have considerably lower GDP per capita than other groups and the highest average unemployment rate. Values on S&T-related indicators are low. | 9.4 | 5.9 | 19 458 |
| Primary-sector-intensive regions<br><br>(19 regions: 3 Greece, 1 Hungary, 12 Poland, 3 Portugal) | These Southern and Eastern European regions with low population density have a significant share of their economy in primary sector activities or low-technology manufacturing. They have, on average, the lowest values on S&T-related indicators (R&D, patenting, share of R&D by business). | 5.0 | 2.4 | 13 880 |

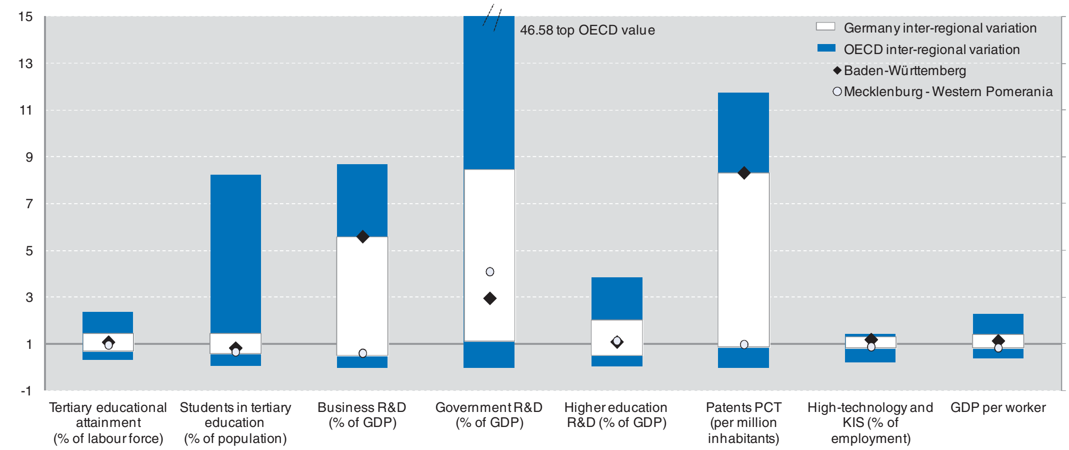
*Source:* Ajmone, G. and K. Maguire (forthcoming), *Categorisation of OECD Regions Using Innovation-Related Variables*, Regional Development Working Papers, OECD Publishing, Paris.

The heterogeneity in RIS between and within countries can also be shown by variations in innovation-related indicators. Figure 1.3 shows the performance of national and regional innovation systems on the basis of eight innovation-related indicators for a high- and a low-performing region in terms of GDP per capita, with respect to the OECD average and the country average.

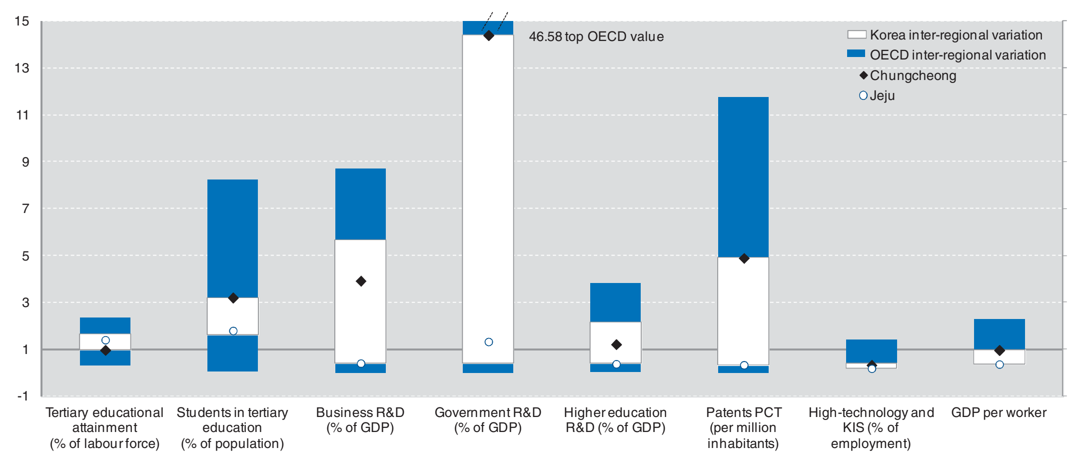
Among the four countries illustrated, Germany, Korea and the United States all show high within-country variance, especially in the case of government R&D support and patenting. On the other hand, Portugal shows low disparities within the country, due to its less developed national innovation system. In the United States, a top region like Massachusetts belongs to the Knowledge and technology hub group, while at the other end of the scale, Mississippi is among US states with average S&T performance. In Germany, Baden-Württemberg is part of the Knowledge and technology hub group, while Mecklenburg-Western Pomerania is in the Structural inertia or de-industrialising regions group. Evidence from Korea indicates its accelerated industrialisation and catching up process. Two of the top-performing regions, Korea Capital Region and Chungcheong, belong to the Knowledge-intensive city/capital district cluster and to the Knowledge and technology hub cluster, respectively; while the region with the lowest GDP per capita, Jeju, is in the Service and natural resource regions in Knowledge-intensive countries group. In Portugal, the top region is the capital city, Lisbon, which belongs to the medium-tech manufacturing and service providers; the other region, Northern Portugal, belongs to the Primary-sector-intensive regions. There is no unique path to success. Several development models may be followed, requiring different policy approaches and institutional settings (see Chapter 2).

Figure 1.3. **Variations in national and regional innovation systems: selected countries**

Germany: Baden-Württemberg and Mecklenburg-Western Pomerania




Korea: Chungcheong and Jeju regions




Portugal: Lisbon and North regions

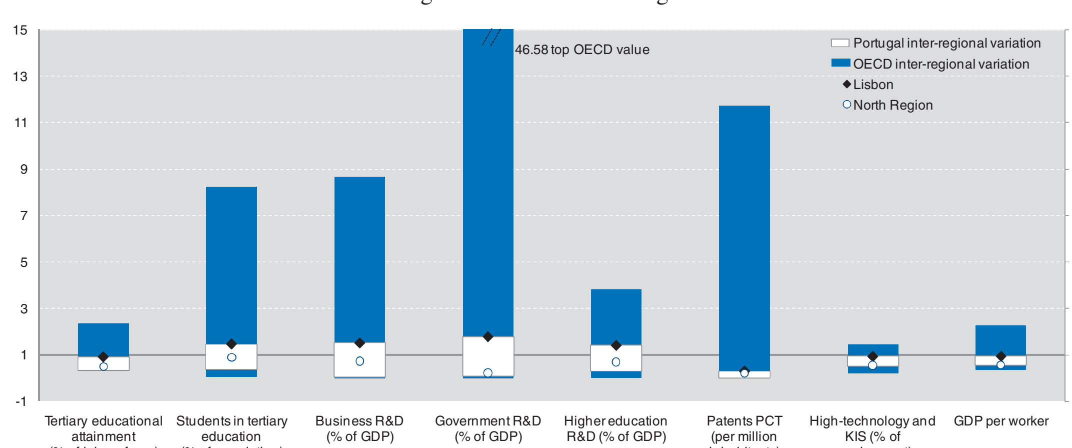
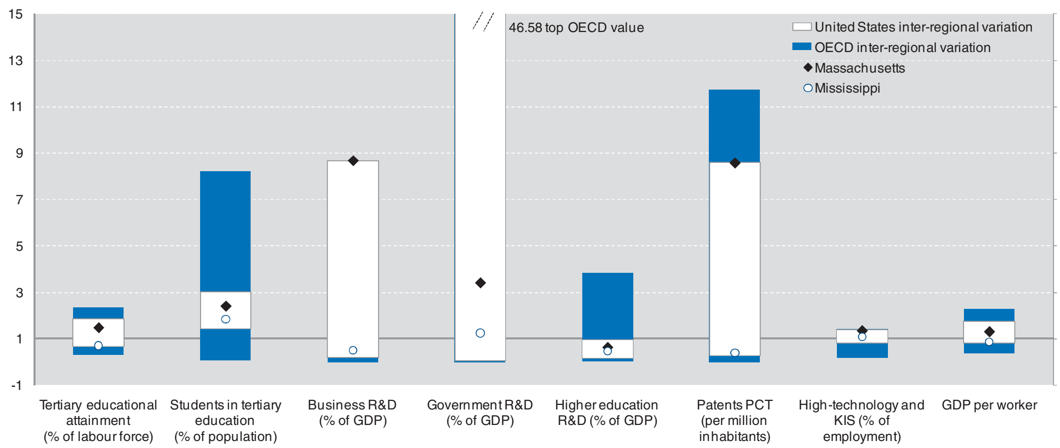


Figure 1.3. **Variations in national and regional innovation systems: selected countries** *(cont'd)*

United States: Massachusetts and Mississippi




Notes: Data is for 2007 or the latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source*: Calculations based on data from the *OECD Regional Database*.

## *Revisiting a key regional asset: human capital*

Human capital is a central asset for regional development. It influences the capacity of a regional innovation system to generate, diffuse and absorb knowledge, and connect with other regions (within or beyond country borders). Figure 1.4 displays the relationship between regional GDP per capita and the share of workers in the labour force with tertiary education, highlighting five OECD member countries (Canada, Germany, Mexico, Spain and the United States). In general, higher GDP per capita is associated with higher shares of skilled personnel in the labour force.

Figure 1.4. **GDP per capita and skilled labour force intensity: a virtuous relationship**


Note: The District of Columbia (United States) does not appear in the figure for ease of display as the GDP per capita (over USD 130 000) is more than double the value of top OECD regions.

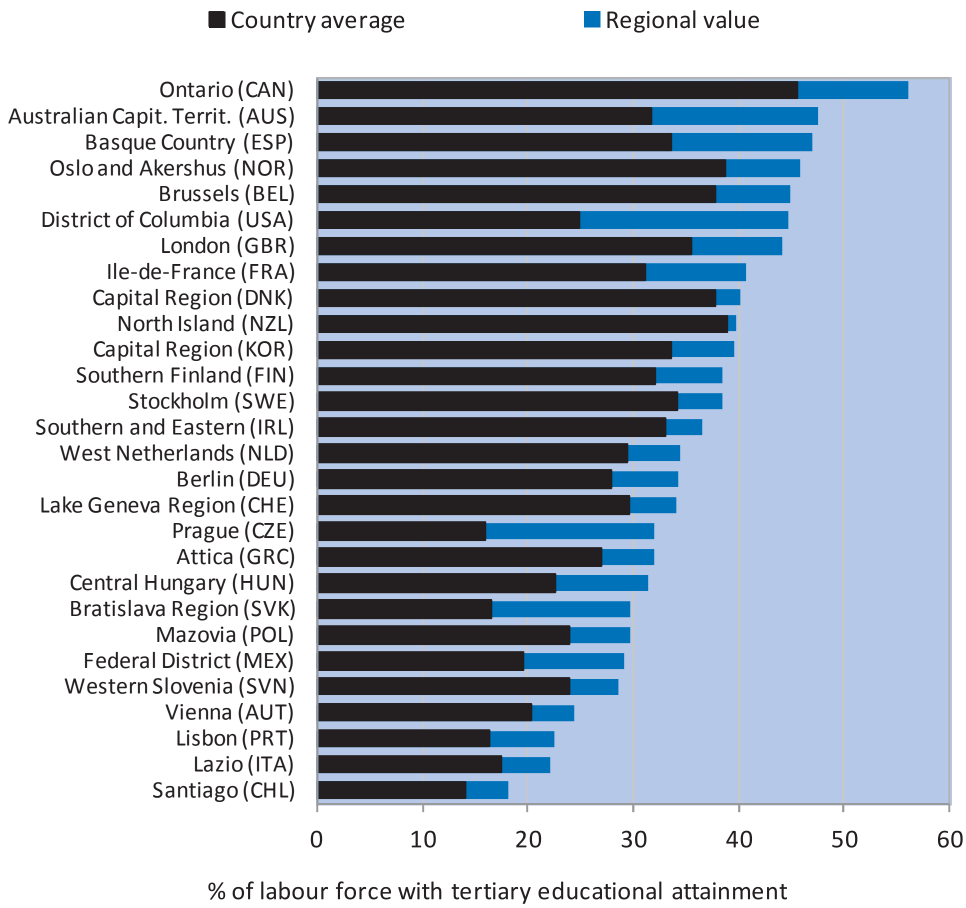
*Source*: Calculations using data from the *OECD Regional Database*.

Figure 1.5 shows the top region by percentage of labour force with tertiary education for each OECD country. The top 10 OECD regions by skilled labour force have 40% of their labour force with tertiary education. Those regions, mostly capitals, include in a decreasing order, Ontario (Canada), the Australian Capital Territory, Basque Country (Spain), Oslo (Norway), Brussels (Belgium), District of Columbia (United States), London (United Kingdom), Ile de France, Capital Region (Denmark) and North Island (New Zealand). The countries with the higher disparity between regions include the United States, where the top region scores 45% versus a national average of 25%, Australia, in which the regional-national divide is 44.7% versus 32%, followed by other countries such as the Czech Republic, Slovak Republic and Spain. The top regions in Chile, Italy and Portugal have the lowest share of skilled labour force relative to OECD regions; in Santiago (Chile), Lazio (Italy) and Lisbon (Portugal) the share of skilled labour force is respectively 18%, 22% and 22%.

However, human capital, especially when highly skilled, is increasingly mobile. Labour force mobility is rising, and the capacity to create, attract and retain talent is crucial for regional development. Skilled and unskilled migrants follow different migration patterns. As Brezzi and Dumont show (OECD, 2010d) the set of top 20 OECD regions for general migration inflows does not exactly correspond to the set of top OECD regions for inflows of skilled migrants. California, New York, Florida, and Texas (United States), Ile-de-France (France), and Ontario and British Columbia (Canada) are in the top 20 regions for migration and skilled migration inflows. However, certain regions show a relative attractiveness for skilled migrants, like Catalonia and Valencia in Spain, Massachusetts in the United States, and North Island in New Zealand (see Table 1.3).

Figure 1.5. **Regions with the highest share of labour force with tertiary educational attainment**

TL2 regions, 2008 or latest year available




*Source: OECD Regional Database.*

OECD (2010d) shows that where highly skilled migrants settle is not only influenced by the prevailing type of labour in demand. It also depends on the socio-economic attractiveness of the receiving region and on complementary services that promote the inclusion of skilled migrants in the local community. There is a certain inertia in the localisation of migrants, with social network effects (for example, the existence of a skilled community of immigrants) playing a decisive role in location choices. The probability of attracting skilled workers of a given location increases where workers of the same origin are already settled in the region. This cumulative effect can favour some regions and keep others trapped in underdevelopment.

Such patterns call for general policies that support training and human capital formation, with differentiated policies responding to regional specificities. The quality and the quantity of human capital can be influenced by several policy levers at the national and the regional level (see Chapter 2).

Table 1.3. **Top 20 regions: recent skilled immigrants**

| Numbers | | % of total population | | Density | |
|---|---|---|---|---|---|
| USA – California | 322 205 | CHE – Lake Geneva Region | 3.4 | ITA – Umbria | 2.7 |
| CAN – Ontario | 275 305 | LUX – Luxembourg | 3.2 | AUT – Vienna | 2.3 |
| USA – New York | 168 816 | NZL – North Island | 3.2 | PRT – Algarve | 2.2 |
| USA – Florida | 167 186 | CAN – Ontario | 2.8 | FRA – Ile de France | 2.2 |
| USA – Texas | 127 010 | CHE – Zurich | 2.7 | USA – District of Columbia | 2.1 |
| AUS – New South Wales | 106 488 | CAN – British Columbia | 2.5 | PRT – Lisbon | 2.0 |
| ESP – Madrid | 106 089 | IRL – Southern and Eastern | 2.4 | NOR – Hedmark and Oppland | 1.9 |
| CAN – Quebec | 99 060 | ESP – Madrid | 2.1 | ESP – Madrid | 1.8 |
| ESP – Catalonia | 91 748 | ESP – Valencia | 2.1 | USA – New Jersey | 1.8 |
| FRA – Ile-de-France | 91 260 | AUS – New South Wales | 2.0 | ESP – Valencia | 1.8 |
| USA – New Jersey | 90 408 | AUS – Australian Capital Territory | 2.0 | ITA – Veneto | 1.8 |
| CAN – British Columbia | 85 520 | AUS – Victoria | 1.9 | ITA – Marche | 1.7 |
| USA – Illinois | 85 077 | NZL – South Island | 1.9 | FIN – Aland | 1.7 |
| ESP – Valencia | 81 914 | CHE – Northwestern Switzerland | 1.9 | CHE – Lake Geneva Region | 1.7 |
| AUS – Victoria | 77 020 | CAN – Alberta | 1.8 | DNK – Capital Region | 1.6 |
| NZL – North Island | 74 907 | AUS – Western Australia | 1.8 | SWE – Stockholm | 1.6 |
| USA – Massachusetts | 59 004 | ESP – Balearic Islands | 1.7 | USA – Florida | 1.6 |
| IRL – Southern and Eastern | 57 623 | CAN – Quebec | 1.6 | HUN – Central Hungary | 1.6 |
| NDL – Western Netherlands | 56 022 | IRL – Border – Midlands and Western | 1.6 | USA – Maryland | 1.6 |
| USA – Virginia | 55 858 | ESP – Catalonia | 1.6 | USA – California | 1.6 |

Note: In the last column, the density index for a region exceeds 1 when the share of skilled migrants exceeds the country average, thus indicating a preference of mobile talent for these regions in their country context. Recent migrants are defined as those settled in the country for less than 5 years and therefore, according to the dataset used by the authors, who immigrated between 2000/01 and 2005/06.

*Source:* OECD (2010), "Determinants of Localisation of Recent Immigrants across OECD Regions", GOV/TDPC/TI(2010)2, OECD, Paris.

### *Variety in regional specialisation in knowledge-intensive activities*

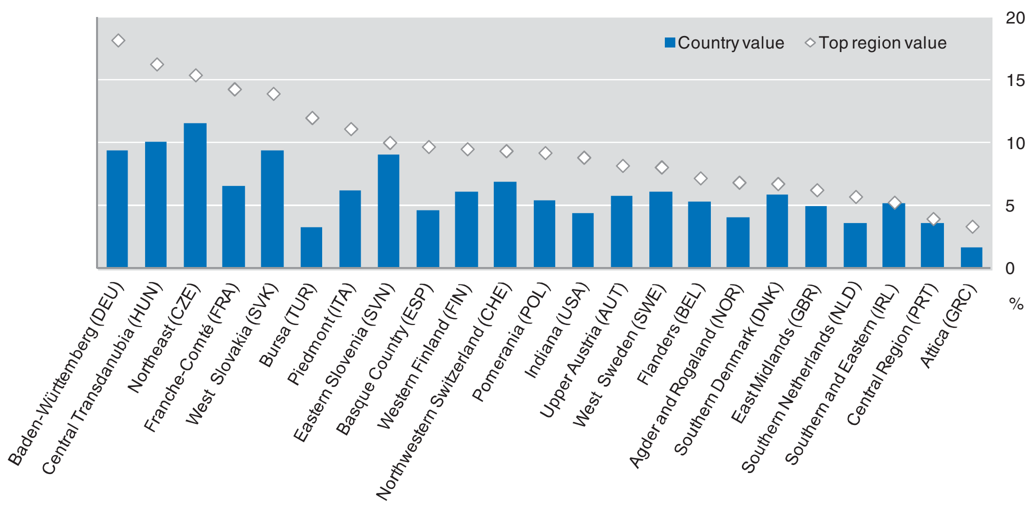
Innovation is sector-specific. Different types of production activities and sectors require different inputs for innovation; they organise the search for ideas and information for innovation differently, require different skills, and diffuse innovation through specific channels. Hence, the production structure specialisation, both in terms of employment and value added, is important for innovation policies because the demand and the need for innovation will differ depending on the prevailing specialisation in each region.

Variations across OECD member countries in terms of specialisation in high- and medium-high-tech manufacturing and in knowledge-intensive services employment on total employment are marked at the regional level. Figures 1.6 and 1.7 show the region with the top share of employment in those two sectors on total regional employment for each OECD member country. In Europe, regions like Baden-Württemberg in Germany, as well as Piedmont in Italy and the Basque Country in Spain, show relatively high specialisation in high- and medium-high-tech manufacturing employment: 18%, 11% and 10% of total employment respectively. As this ratio considers total employment, it gives greater weight to regions with a high share of manufacturing in the economy. However, in some countries, the regions that may be most high-technology intensive within manufacturing could differ.

Knowledge-intensive services are a major source of employment in capital regions in the OECD. Top innovative countries such as Sweden, the United Kingdom, Norway, Denmark, the United States, Finland and Switzerland show, on average at the country level, a share of employment in KIS above 40%. Within those countries, the top region, usually the capital, has more than 50% of employment in KIS.

Figure 1.6. **Regional specialisation in high- and medium-high-tech manufacturing employment**

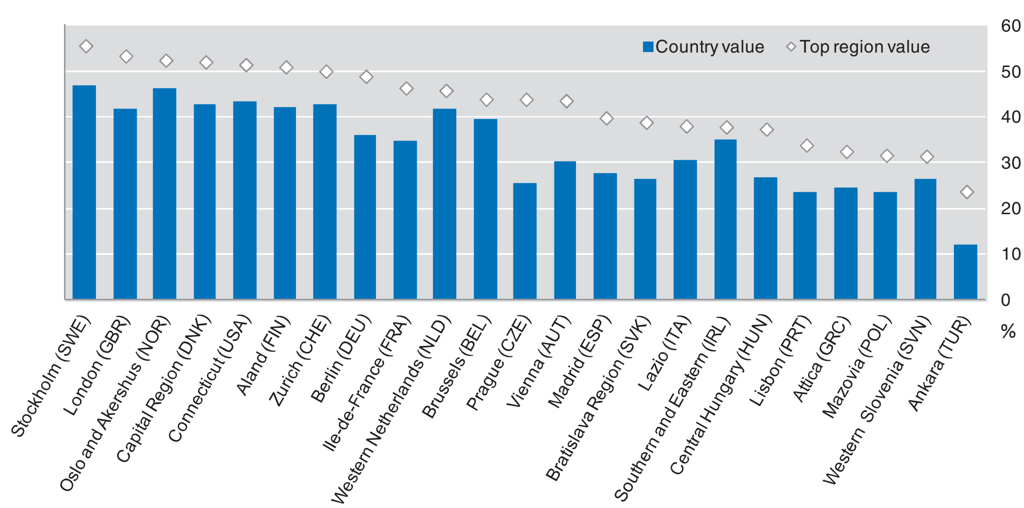
Medium- and medium-high technology employment as % of total employment, 2008




*Source*: *OECD Regional Database*.

Figure 1.7. **Regional specialisation in knowledge-intensive services (KIS) employment**

Knowledge-intensive services as % of total employment, 2008




*Source*: *OECD Regional Database*.

### *Between and within country heterogeneity in R&D efforts*

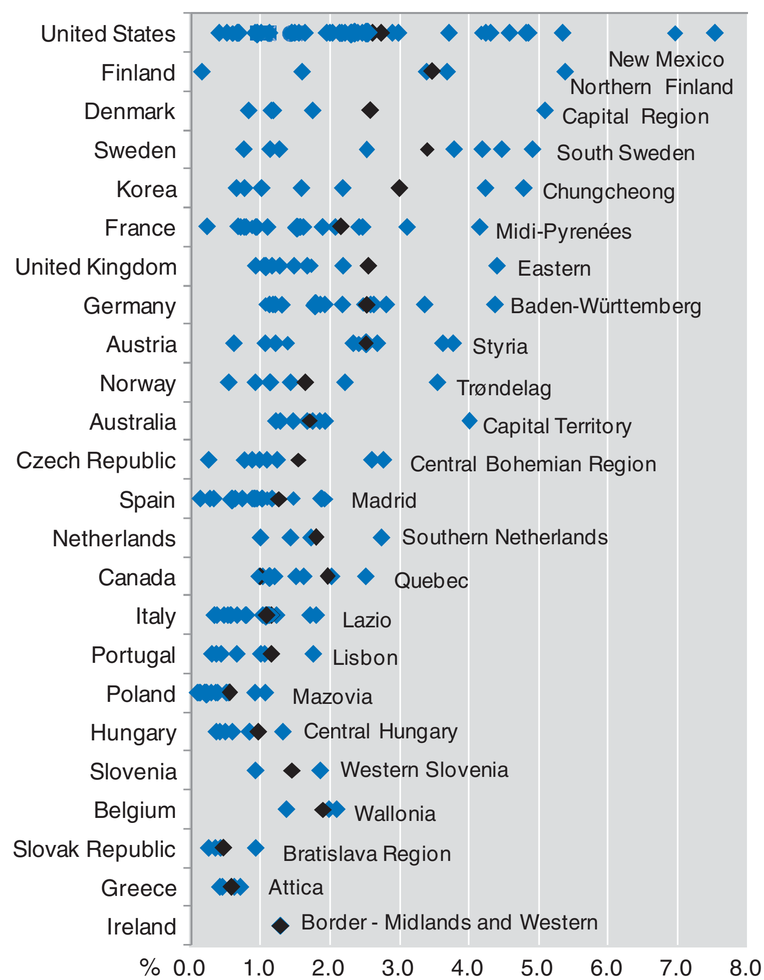
R&D efforts are highly sector-specific. On average, pharmaceuticals, biotechnology and electronics are usually more R&D intensive than, for example, the textile or wood industries. For this reason, investment in R&D is highly concentrated in a group of major global players in high-tech manufacturing. But new actors are appearing, especially in emerging economies (OECD, 2010b).

In the OECD, around 13% of the regions account for 50% of total R&D expenditures. Therefore, in-country dispersion in regional R&D efforts is not a positive or negative feature per se; it needs to be evaluated along with aggregate national performance and the specificity of the country in question.

Figure 1.8 shows both national R&D intensity (R&D investments as a % of GDP) and regional heterogeneity in R&D intensity. The relationship between national investment and within-country differences in R&D intensity is varied and illustrates that different innovation models co-exist. There are multi-polar R&D models with high heterogeneity like the United States, more diffused models like Germany, or highly polarised models, such as France or Korea. Regional R&D hot spots have emerged in countries that are not the most R&D-intensive, such as South Netherlands and Trøndelag in Norway. These two regions invest more than double their respective average R&D country intensity. Countries with low national R&D intensities, such as Greece and Hungary, may display low dispersion between regions, but due to the low level of R&D effort in all the regions; or high dispersion if R&D intensity is concentrated in only a few poles, as in Portugal.

Figure 1.8. **Heterogeneity in R&D intensity in OECD member countries and regions**

R&D expenditure as a percent of GDP, TL2 regions, 2007 (or latest available year)



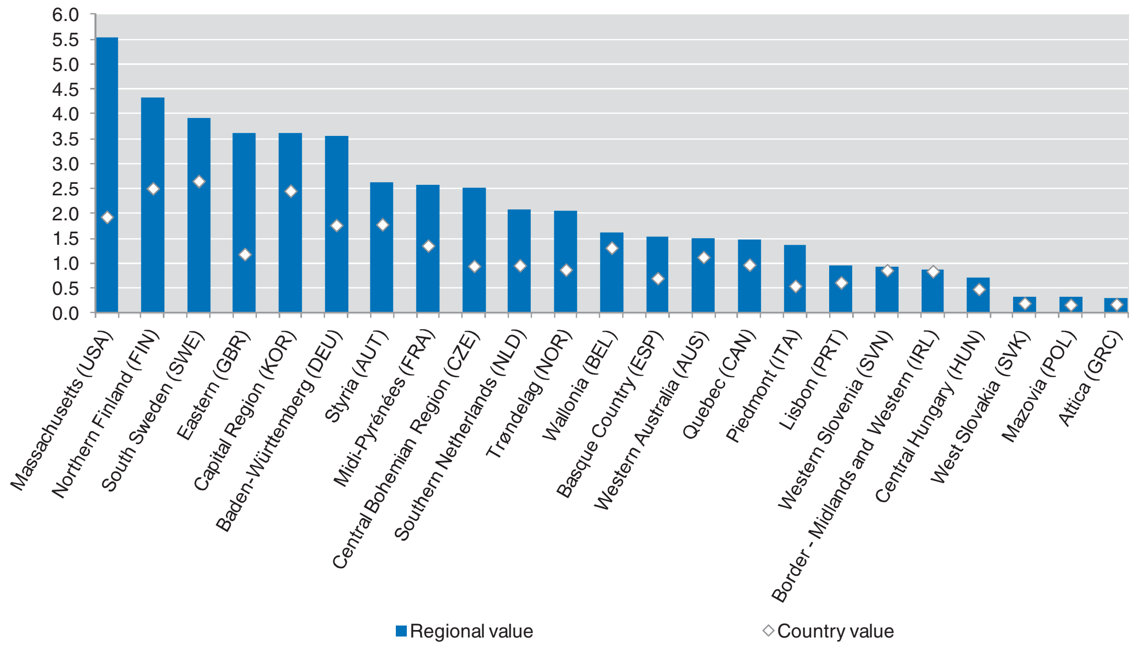

Note: The dark diamond is the value for the country. The other diamonds are the values for regions at TL2 level.

*Source: OECD Regional Database* and *MSTI Database*.

Top R&D-intensive regions tend to be located in top R&D-intensive countries. Figure 1.9 shows the top region by country for business R&D investment. In the United States, Massachusetts is double the country average, and also ranks at the top of OECD regions, with an investment of 5.5% over regional GDP. The United States, Finland, Sweden, the United Kingdom, Korea and Germany are the six countries in which the top region invests more than 3.5% of regional GDP in R&D.

Figure 1.9. **Top regions by country for business R&D intensity, 2007**

Business Enterprise Research and Development (BERD) expenditure as a % of GDP



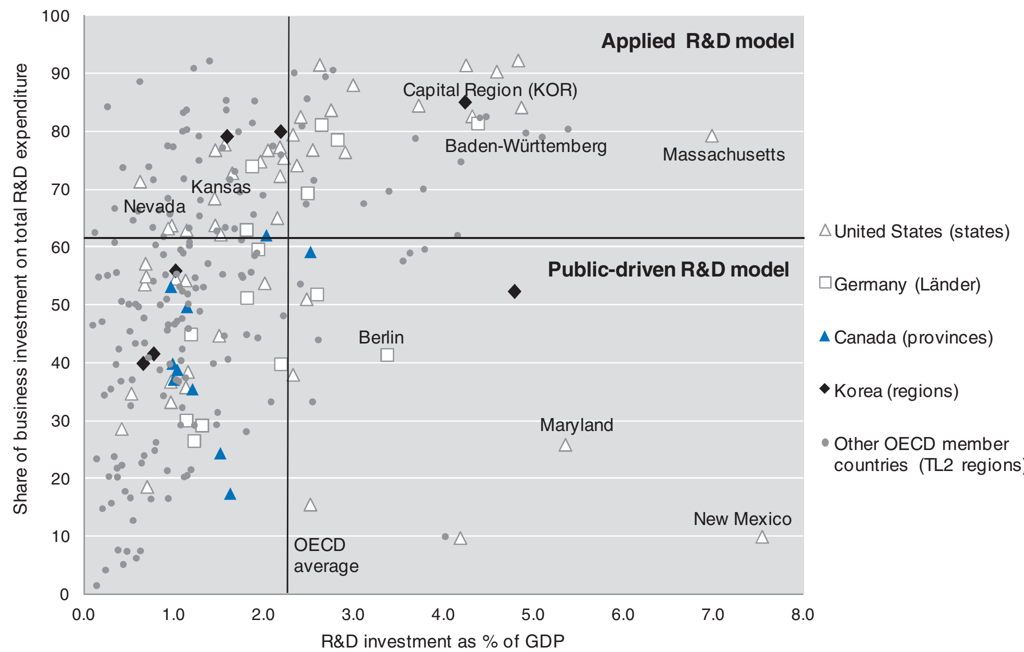

*Source*: *OECD Regional Database*.

R&D models differ according to sources of financing (mainly public funds and business investments) and by performing institutions (business sector, governmental institutions, higher education institutions and others). In OECD member countries, two-thirds of R&D expenditure on average is carried out by the private sector. Figure 1.10 shows the variety in R&D models across regions in OECD countries. It shows regional R&D intensity on the horizontal axis and the share of regional R&D performed by the business sector. Regions in Canada, Germany, Korea, and the United States are displayed, along with those of 20 other OECD member countries. Different models emerge between and within countries. Few regions are highly intensive in R&D. In fact, the majority of OECD regions belong to what can be called a "low R&D-intensive model". These regions are located in the top-left and bottom-left quadrants. The majority show low levels of R&D investment as a percentage of GDP overall and scant business contribution to R&D expenditure (bottom-left quadrant). This group also includes regions from top R&D countries such as the United States, Germany and Korea. The top-left quadrant groups regions with a low R&D-intensive model, but which in any case show the business sector as the main agent in R&D activities, such as Kansas and Nevada in the United States.

The right side of the figure shows top R&D-performing regions. The top right quadrant includes major knowledge hubs dominated by an applied R&D model. This group is characterised by a strong share of the private sector in R&D, together with a high commitment from the public sector to support R&D and innovation. Baden-Württemberg, the Korean Capital Region and Massachusetts belong to this category. The bottom-right quadrant groups the few R&D-intensive regions with a mainly public-driven model, in which universities and public laboratories play a major role in R&D, as in the cases of Berlin (Germany) or Maryland and New Mexico (United States).

Figure 1.10. **R&D expenditure: regional models of public and private performance**

TL2 regions, 2007




*Source: OECD Regional Database.*

### *Patenting trends: major players in key technology fields and collaboration patterns*

Patents are one of the mechanisms firms use to appropriate the results of investments in intangibles with industrial applicability. They are considered a good proxy of innovation efforts, but mainly in certain technological areas, like pharmaceuticals, electronics, etc. (Grilliches, 1990). It is important to bear in mind that patenting activity is strongly associated with sectoral patterns (i.e. certain economic sectors tend to show higher patenting trends, due to the type of innovative activity). The most patent-intensive sectors are biopharmaceuticals, electronics and certain mechanical sectors. In addition, other appropriability strategies and mechanisms exist, like trade secrets, industrial design or complementary manufacturing capacities, which firms use to secure their innovation rents (Cohen, Nelson and Walsh, 2000).

In addition to facilitating the application and diffusion of technical knowledge, patents are also used for strategic purposes. This is the case of defensive or sleeping patents, for example, and for signalling reasons. The determinants of patenting are related to the specific sector or technology in question, and they are also strongly shaped by the set of institutions governing the intellectual property system (Cimoli, Coriat and Primi, 2009). At the regional level, patent-based analyses are relevant indicators for regions with a significant specialisation in high-tech sectors. The analysis of patenting trends and distribution across regions between and within countries helps explain the territorial localisation of patenting players and the linkages between them.

Patenting in key technological paradigms, such as ICT, biotechnology and green technologies, continues to rise. The distribution is highly concentrated in the famous "knowledge club" dominated by the United States, Japan and Germany. However, the last decade has seen a change in the dominant actors, both at a national and regional level, which follow different patterns in the various technological fields (see Figures 1.11, 1.12 and 1.13).

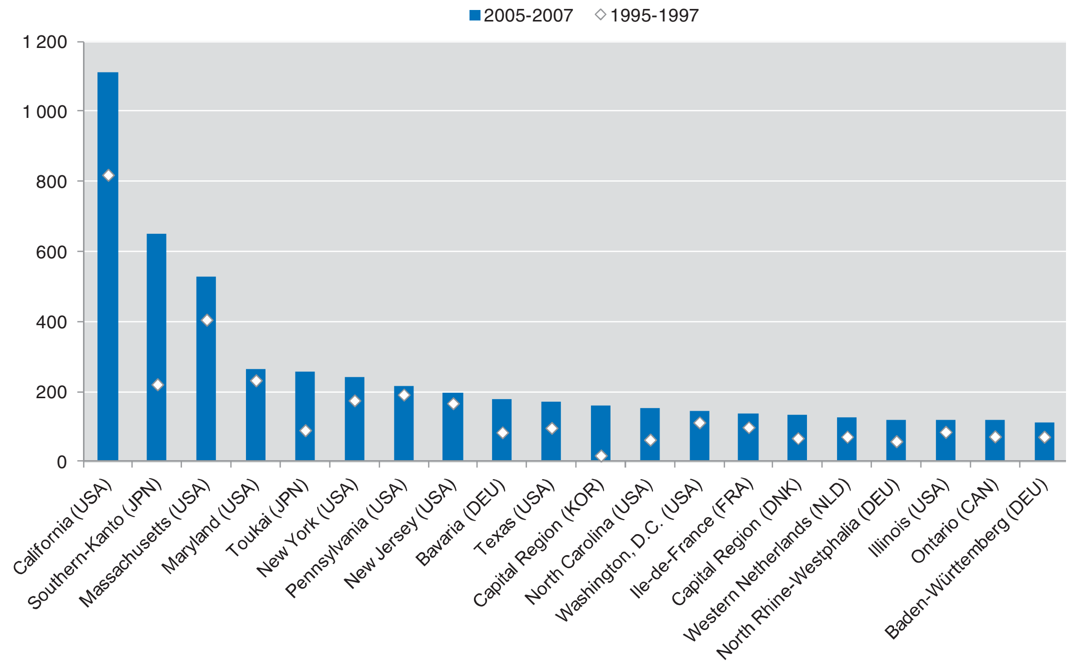
In biotechnology, the top 20 patenting regions between 2005 and 2007 accounted for 18% of total OECD patenting. Half of those regions were located in the United States, followed by regions in Japan, Germany, Korea, France, Denmark, the Netherlands and Canada. The top patenting region in the field was California, accounting for 4% of total OECD patenting in biotechnology. All regions have increased the number of their patent applications in the last ten years. Between 1995 and 1997, the same group of regions accounted for 59% of total patenting in the OECD. The reduction in the concentration, and a rising number of patent applications, indicates that new players have appeared in biotechnology patenting. Korea's Capital Region is one of the most dynamic regions in the OECD in this field. Patent applications there increased ninefold between 1995-97 and 2005-07. Korea's Capital Region is also the only region that increased its share of total OECD patenting over that period. The other two regions that markedly increased their patent activity, with a threefold increase in the number of patent applications, are the Japanese provinces of Southern Kanto and Toukai.

In green technologies, the top 20 regions in patent applications in 2005-2007 accounted for around 17.9% of total OECD patenting in this field. This technological field is less geographically concentrated than biotechnology. The top 20 regions were in Japan, Germany, the United States, the Netherlands, France and Canada. The major players were two Japanese regions, Southern Kanto and Hokuriku, which accounted for around 6% of total OECD patenting. The most dynamic OECD region was Hokuriku, for which patent applications increased 28 times between 1995-1997 and 2005-2007. This region was the only one to increase its share of the OECD total for applications, from 0.8% to 2.7% over the same period. The next most dynamic region was the Capital Region of Korea, where the number of applications has increased eightfold over the last decade. It is followed by Baden-Württemberg in Germany and Michigan in the United States, both of which more than tripled the number of their patent applications.

ICT is the most mature and concentrated model. The top 20 OECD regions account for almost 62% of all OECD patent applications. The top two regions are Southern Kanto and California, which account for 14% and 12% of total OECD patent applications respectively. The top 20 regions include several US states (accounting for 25% of total OECD patenting), and regions in Germany, Korea, France, Denmark, the Netherlands and Canada. The most dynamic region over the last decade was the Capital Region in Korea, where patent applications increased by a factor of 40 in 10 years, raising its share in total OECD patent applications from 0.11% to 4.2% between 1995-1997 and 2005-2007. The Japanese provinces of Southern Kanto and Toukai follow Korea in terms of dynamism, and increased their number of patent applications more than sevenfold over the same period. Another region with a remarkable sixfold increase in the past decade is Washington, D.C.

Figure 1.11. **Top 20 OECD regions in biotech patenting, 2005-2007**

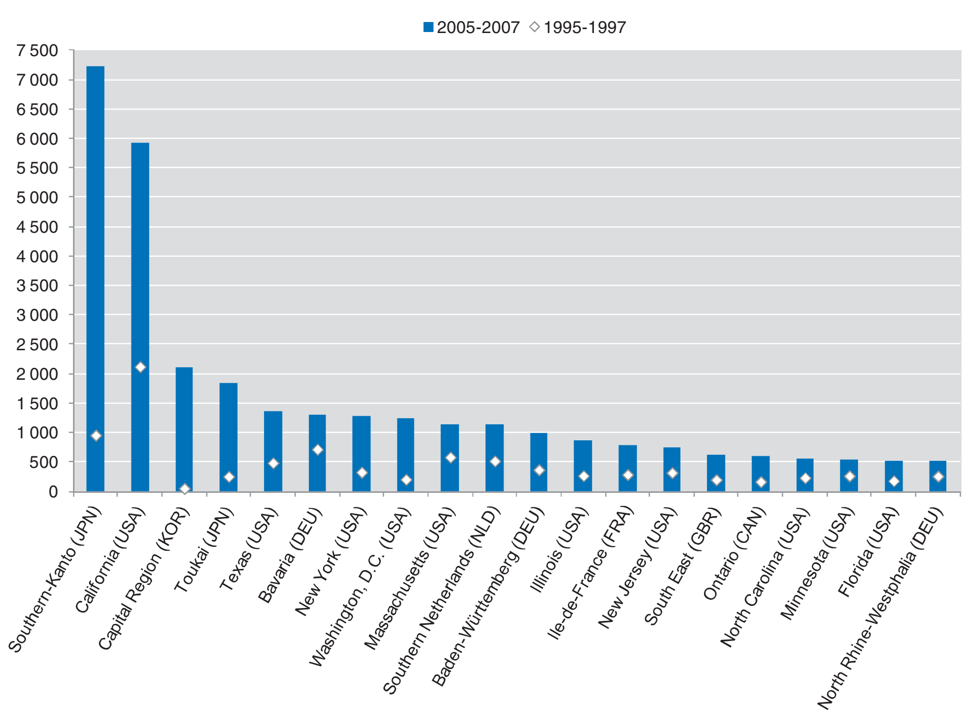
Patent Co-operation Treaty patent applications by TL2 regions




*Source: OECD Regional Database* and *OECD REGPAT*.

Figure 1.12. **Top 20 OECD regions in ICT patenting, 2005-2007**

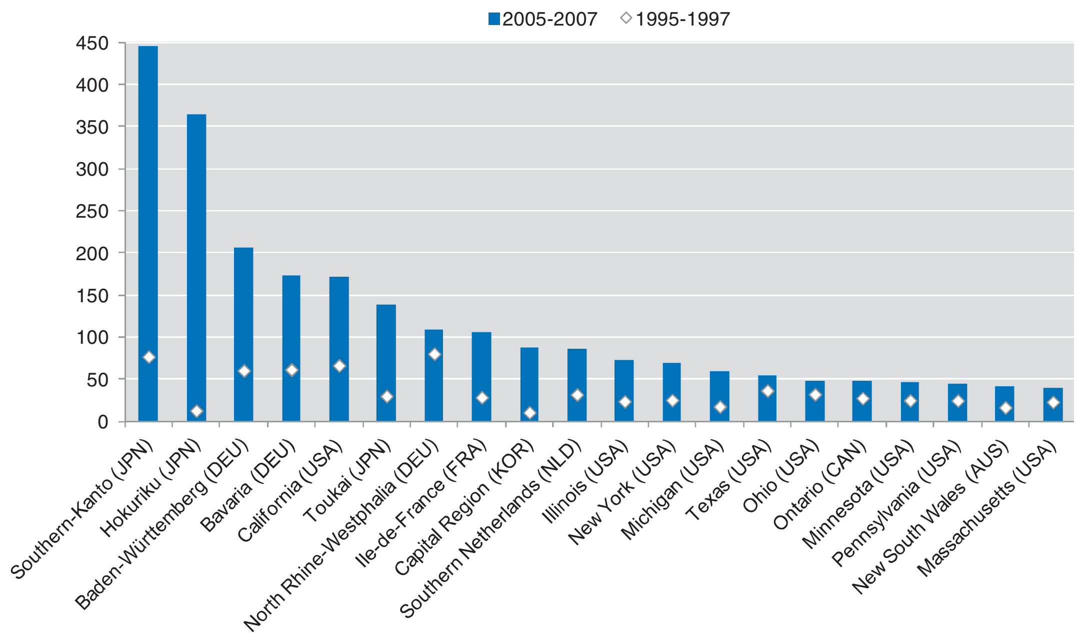
Patent Co-operation Treaty patent applications by TL2 regions




*Source: OECD Regional Database* and *OECD REGPAT*.

Figure 1.13. **Top 20 OECD regions in green technologies patenting, 2005-2007**

Patent Co-operation Treaty patent applications by TL2 regions



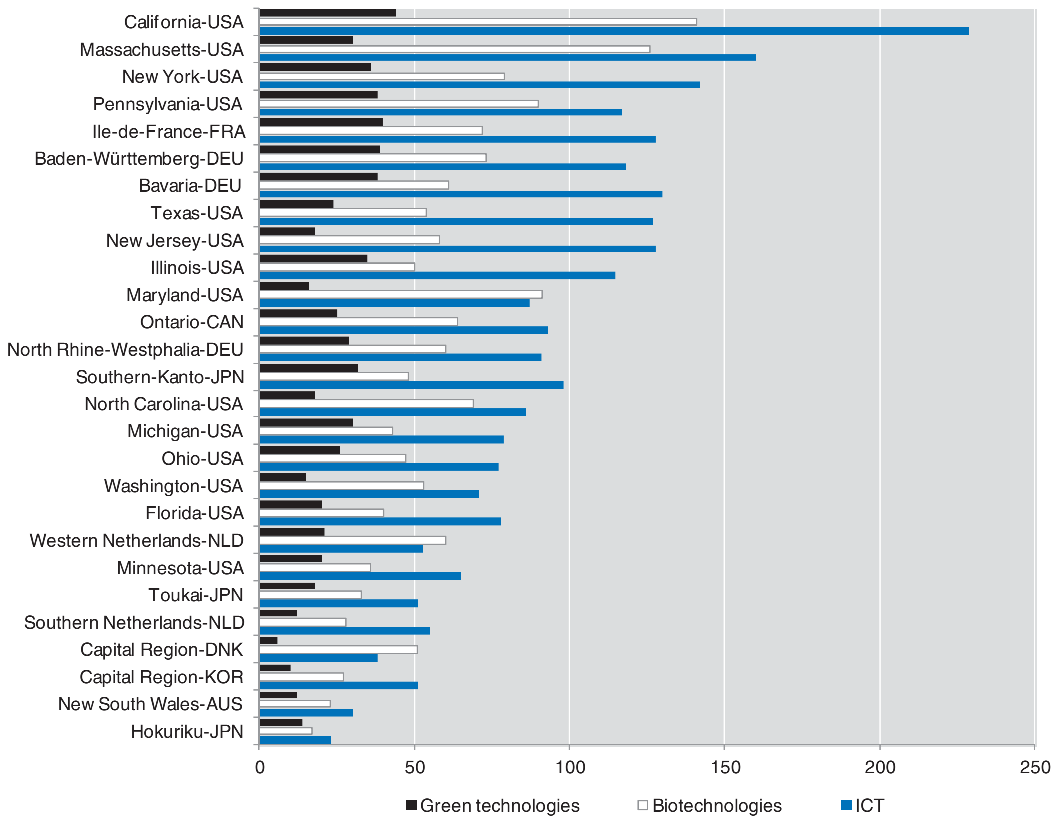

*Source: OECD Regional Database* and *OECD REGPAT*.

Patenting behaviour is also evolving rapidly. Co-operation in patenting is rising steeply, but the intensity in collaboration varies across sectors, countries and regions. ICT is the most collaboration-intensive area. For the top 20 regions, the average number of regional co-inventors in ICT collaborative patents rose from 37 in 2001 to 101 in 2007. In biotechnology, this number almost doubled, from 36 to 64. In green technologies, it rose from 9 to 25 co-inventors.

Figure 1.14 shows the number of regional co-inventors for the top patenting OECD regions in ICT, biotech and green technologies. The top three regions with the more "diversified" co-inventorship model (i.e. with the highest average number of co-inventors) in the three areas are California, Massachusetts and New York. The propensity to collaborate and produce networked patents depends on a series of factors related to the type of technology, the characteristics of the inventor and the institutional and cultural characteristics of the region. Among top-patenting agents, different collaborative patterns emerge. Top patenting players in Asian countries, such as Japanese and Korean regions, tend to collaborate with a reduced network of inventors. Within the United States, top patenting players show different co-inventor profiles, with some of the top patenting regions showing the highest numbers of co-inventors among all OECD regions.

Figure 1.14. **Number of co-inventors for top patenting regions: green technologies, biotech and ICT**

TL2 regions, PCT patent applications, fractional count;
by inventor and priority year for patents with more than one co-inventor, 2007

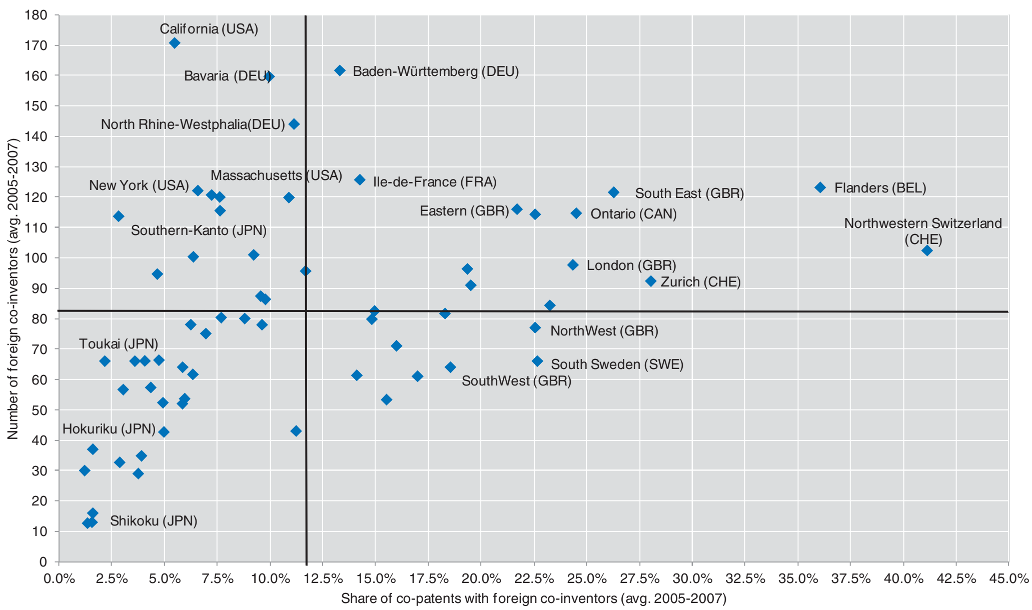



*Source: OECD Regional Database* and *OECD REGPAT*.

In general, when looking at regional data, co-inventors tend to be located within the same region, or in the same country, showing the importance of location and concentration in inventive activities. However, different collaboration models emerge between and within countries. Figure 1.15 shows the variety and the intensity in foreign patent collaboration, as measured by co-inventions, of the top 20% OECD patenting regions. Those regions account for more than 70% of total OECD patent applications via the PCT (Patent Co-operation Treaty). Four different models of foreign collaboration emerge. The top-left quadrant groups regions that have a relatively low share of co-patents with foreign co-inventors, but a high variety of foreign partners. This is the case for big technology hubs, such as California, Bavaria, Massachusetts, etc. The bottom-left quadrant groups regions with a more inward-oriented model, showing a reduced number of co-inventors from outside the region. The bottom-right quadrant shows regions that collaborate with a relatively low number of foreign partners, but where those collaborations represent a high share of total co-invention activities, as in the North West and South West regions of the United Kingdom. The top-right quadrant displays regions with the most open collaboration model. They tend to have co-inventors in many other countries, and the share of their collaborations in total co-invention activities is high. This is the case for Ontario, Baden-Württemberg, and some European capital regions such as Ile-de-France (Paris), London and Zurich.

Figure 1.15. **Variety and intensity in foreign patent collaboration: co-inventorship patterns**

Top 20% of OECD TL2 regions (by number of total PCT applications), 2005-2007




*Source*: OECD (forthcoming), *OECD Regions at a Glance – 2011 edition*, OECD Publishing, Paris.

An analysis of the network of regional co-inventorship for top patenting regions shows that the majority of co-inventors tend to be located within the same region and within the same country. This is a common pattern regardless of the level of the region's propensity to apply for patents with multiple co-inventors. Figure 1.16 shows the network of co-inventors of Hokuriku (Japan), Baden-Württemberg (Germany) and California (United States) in green patent applications for the period 2005-2007 and 1995-1997.

These three regions display distinctly different collaboration patterns. Hokuriku shows a closed co-inventorship model, with few linkages outside Japan. Baden-Württemberg shows the most open co-inventorship model, having linkages with several partners located mostly in northern European countries and in several American states. The region has maintained persistent and intense co-inventor relationships with Swiss and Austrian regions, as well as new partnerships with several UK regions. California shows a relatively open co-inventorship model, but with a higher preference for in-country co-inventors than Baden-Württemberg. The network of co-inventors for California suggests a strategic attitude: co-inventorship with emerging economies such as India and China and with Southern Kanto from Japan (the top patenting region in green technology) and intense co-inventorship with top German regions, if not with Baden-Württemberg.

The network of co-inventors for the same regions in 1995-1997 shows the increase by 2005-2007 in patent applications from all players and the intensification of the network for Baden-Württemberg and California. Hokuriku (Japan), which has been the most dynamic in green patenting in the last decade with an increase from 12 to 364 patent applications between 1995-1997 and 2005-2007, shows a persistent low level of openness for co-inventorship, but a reshuffling in the regional partners.

Figure 1.16. **Regional network of co-inventors in green patent applications**

Hokuriku (Japan), Baden-Württemberg (Germany) and California (United States), 2005-2007

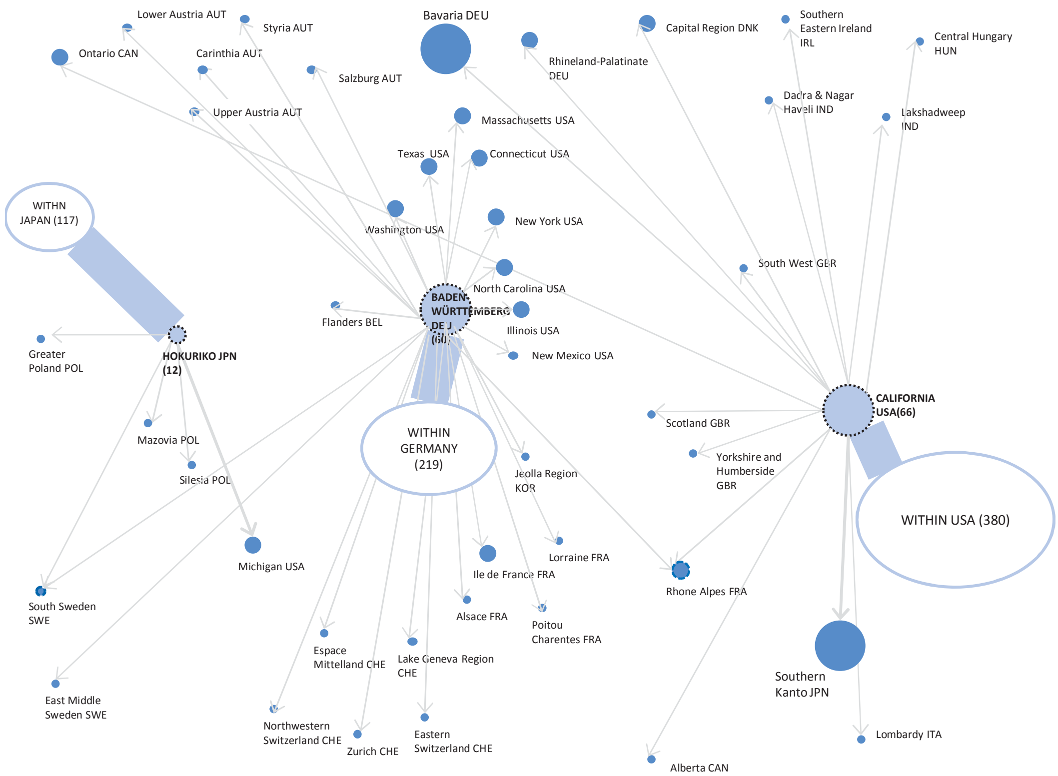
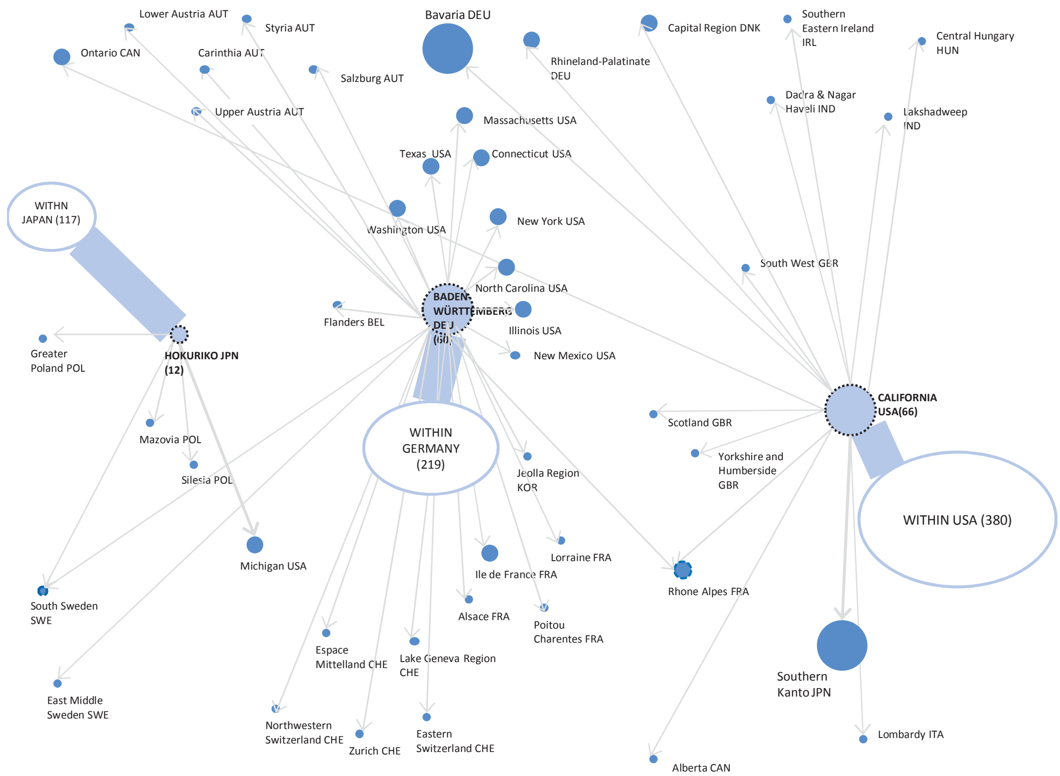


Figure 1.16. **Regional network of co-inventors in green patent applications** *(cont'd)*

Hokuriku (Japan), Baden-Württemberg (Germany) and California (United States), 1995-1997




Note: The size of the bubbles reflects the number of patent applications in green technologies for each region (yearly average in each of the two periods 1995-1997 and 2005-2007). The smallest bubble size indicates that the region presented, on average, less than ten PCT patent applications for the indicated period. The second smallest bubble size indicates between 10 and 50 patent applications, and next size between 50 and 100. When a region has more than 100 patent applications, the number is indicated in brackets. The thickness of the link indicates the intensity of co-inventorship linkages with the regional partner. The finest line indicates that there are between one and four co-inventors located in the region. In India and China it was not possible to determine the number of patent applications of a given region, since the database had been regionalised only for OECD member countries at the time of this analysis.

*Source*: Calculations based on the *OECD REGPAT Database*.

## *Beyond technology: adding value by investing in non-technological innovations and creativity*

While innovation is increasingly seen as the new source of growth, it involves several dimensions beyond the traditional aspects of scientific and technological research. OECD member countries have shown new interest in understanding and measuring the innovation process, beyond R&D and patent indicators, to better inform the policy discussion. This concern is even more prevalent in the regional context, given that many regional and local production systems have important innovative potential but rely on innovation models that are not science driven. Examples are the textile and fashion districts in France and Italy, the design industries in Denmark, Finland, Italy and the

United Kingdom, and cultural industries such as architecture, performing arts, books and publishing, etc.

New measurement approaches are needed to account for the multiple facets of the innovative process, both in traditional industrial activities and in creative industries. Clearly, R&D investments are only one determinant of innovation. The methodology and data are lacking to fully measure other innovation-related investments beyond R&D in countries and regions. At the level of the firm, the data shows that companies use several sources of information for innovation. Skills, networks and informal contacts with competitors, clients and others agents of the innovation system influence their innovative performance.

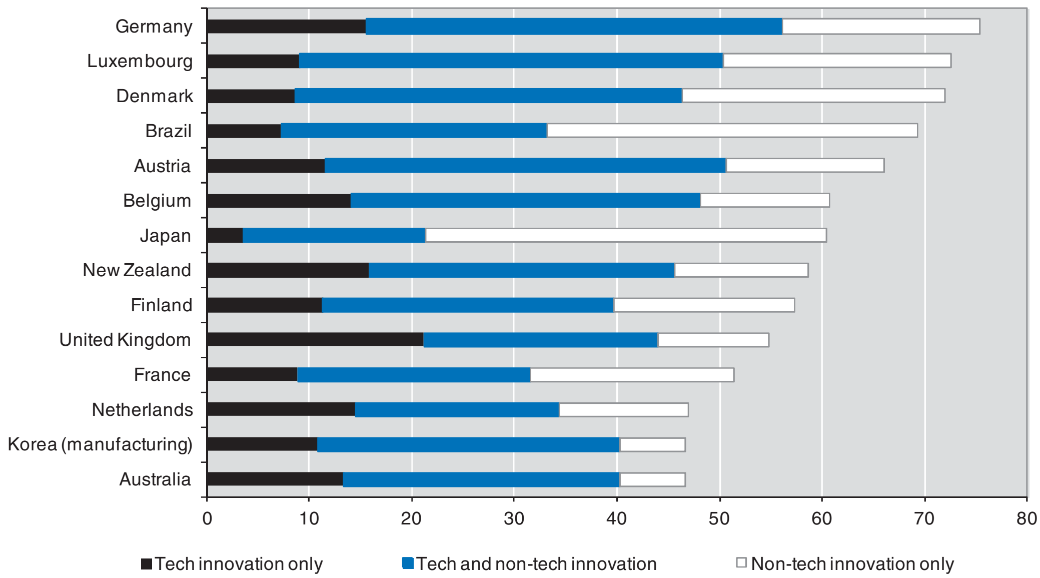
The measurement agenda at regional level could therefore consider other innovation investments. Such factors include: skills and competences; organisational upgrading, and other intangibles. Experimental trials have been conducted, for example in Denmark and the United Kingdom, to quantify a broader view of innovation. A pilot study by NESTA (the United Kingdom's National Endowment for Science, Technology and the Arts) shows that around 75% of innovations in the United Kingdom derive from investments in activities other than traditional R&D investments, including investments in skills, organisational innovations and design (NESTA, 2009).

Evidence from innovation surveys shows that innovative firms tend to rely on complementary innovation strategies. They introduce not only new products and processes (technological innovations) but also new management and business practices (non-technological innovations). Figure 1.17 shows that less than 20% of firms in all countries restrict their efforts to technological innovation alone, while the majority of firms implement both technological and non-technological innovations (OECD, 2009).

OECD member countries have been increasingly interested in understanding and measuring the role of creative industries in growth and development. Creative industries such as design, architecture, advertising, visual and performing arts, and software design add value in several ways. They provide cultural goods and services, create new experiences and services for users, and support productivity in traditional sectors. Creative industries produce and innovate differently from traditional manufacturing sectors. They rely heavily on human capital, skills and talent. The search process for novelty is less dependent on large-scale scientific infrastructure, and they usually include a high share of self-employed and small businesses. The peculiarities of such industries call for a differentiated policy support.

The performance of those industries is poorly captured by traditional business and industrial indicators. Defining and measuring the contribution of creative industries to value added and the innovation process has yet to be developed and generalised. Local and regional administrations tend to be in a better position to identify the specificities of those activities, since the characteristics of creative assets and talents are highly contextual and localised. For example, the New England Foundation for the Arts, based in Boston, Massachusetts carried out a pilot study to measure the impact and performance of creative industries. Table 1.4 shows the employment in cultural enterprises in the six US states of New England. The Cultural Enterprise Location Index shows that Connecticut, Massachusetts, and Rhode Island overall are relatively more specialised in cultural industries than the country average. In Massachusetts, for example, 44 500 people work in design, as independent designers, employees of design firms and as in-house designers in numerous industries.

Figure 1.17. **Technological and non-technological innovators, all firms, 2002-2004**




Notes: For Australia and New Zealand: 2004-2005; for Japan: 1999-2001; for Brazil: 2003-2005. Figures for Australia include firms with fewer than 10 employees, and the reference period for the Australian 2005 Innovation Survey is two years rather than three. Both these differences can be expected to have a downward impact on the share of innovative firms.

*Source:* OECD (2009), *Innovation in Firms: A Microeconomic Perspective*, OECD Publishing, Paris, doi: 10.1787/9789264056213-en.

Table 1.4. **Regional cultural enterprise employment: New England states (US)**

2002

| | Connecticut | Maine | Massachusetts | New Hampshire | Rhode Island | Vermont | New England | United States |
|---|---|---|---|---|---|---|---|---|
| Cultural enterprise employment | 68 827 | 16 643 | 132 011 | 21 654 | 25 453 | 10 131 | 274 719 | 4 587 826 |
| Cultural enterprise % of total employment | 4.13 | 2.75 | 4.06 | 3.50 | 5.32 | 3.38 | 3.97 | 3.52 |
| Cultural enterprise location quotient | 1.17 | 0.78 | 1.16 | 1.00 | 1.51 | 0.96 | 1.13 | 1.00 |

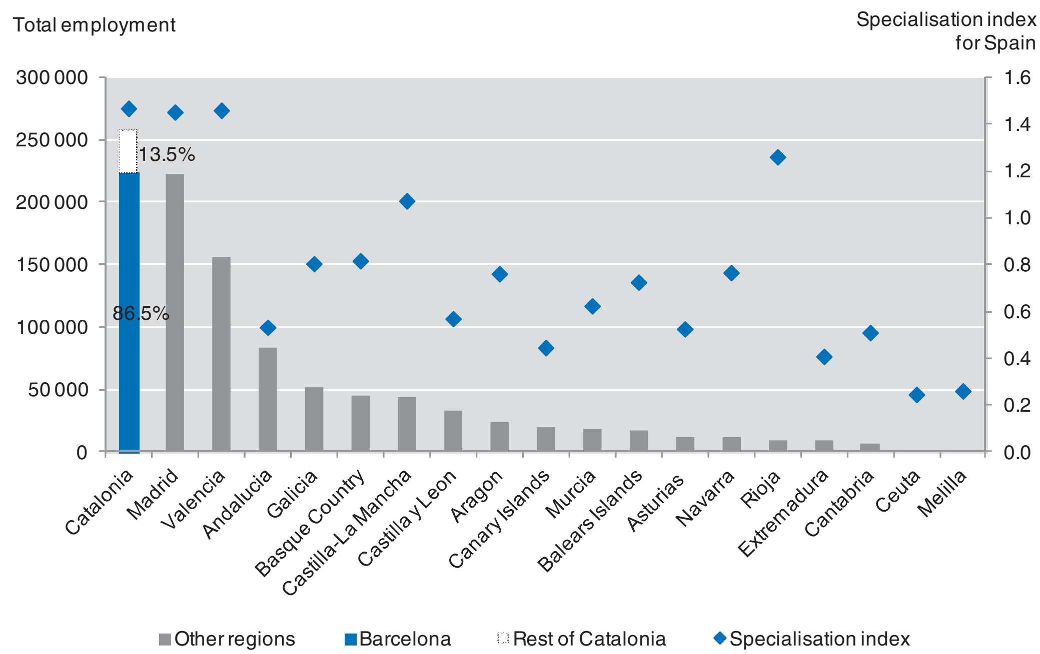
Note: A location quotient is the share of total employment in a region originating in a particular sector, divided by the same sector's share in total national employment. A location quotient greater than 1 shows that the region has more than the national average share of employment in that sector.

*Source*: New England Foundation for the Arts (NEFA) (2007), *The Creative Economy: A New Definition*, NEFA, Boston, Massachusetts. Cultural Enterprise employment data are from the 2002 Economic Census; state and national employment data are from the Federal Reserve Bank of Boston and the US Bureau of Labor Statistics.

European countries have also been trying to measure specialisation in creative industries. The recent rise of Barcelona as a European creative hub is an interesting example. Figure 1.18 shows the regional specialisation in cultural and creative industries in Spain. Creative industries are mostly concentrated in the two regions hosting the major cities, Catalonia and Madrid. Catalonia is the region of Spain with the largest number of workers in cultural and creative industries. Its main regional cultural hub is Barcelona, which accounts for 86.5% of the region's employment in culture and creative industries (OECD, 2010e).

Figure 1.18. **Employment in cultural and creative industries in Spain**

2001




Notes: This figure includes all cultural and creative NACE (Nomenclature of Economic Activities) 1.1 categories except: 52.12 – Other retail sale in non-specialised stores; 52.48 – Other retail sale in specialised stores; 52.63 - Other non-store retail sale; 74.81 – Photographic activities; 74.87 – Other business activities n.e.c. (not elsewhere classified); and 92.72 – Other recreational activities n.e.c. (see Cultural and Creative Classification in OECD (2007), "International Measurement of the Economic and Social Importance of Culture", STD/NAFS(2007)1, OECD, Paris, *www.oecd.org/dataoecd/56/54/38348526.pdf,* p. 14).

*Source:* OECD (2010), calculations based on data from the Spanish Statistical Institute (INE), Census 2001.

Monitoring innovative conduct and analysis of the complementarities between different forms of innovation is a key issue for a new measurement agenda (OECD, 2010). For example, there are complementarities between technological improvements and design. As part of the European Year of Creativity (2009), the EU supported several programmes to advance the measurement of innovation. In this framework, one study applied the traditional EU scoreboard approach to measuring design, creativity and innovation in Europe (Hollanders and van Cruysen, 2009). The authors identified a set of 30 indicators capturing both the creative climate (including indicators accounting for creative education, self-expression, openness and tolerance) and the structural conditions for creativity and design activities (such as measures for the creative sector, creativity in R&D, design activities, competitiveness in design). Using these measures, European countries with the most creative climate are Sweden, Denmark and the Netherlands, followed by Belgium and the United Kingdom. Eastern European countries show the lowest levels of creative climate. The top five European countries in the performance of creative and design industries are Denmark, Sweden, the Netherlands, Finland and Germany. The report's findings also show that higher levels of creativity (as measured by the composite indicator presented) are associated with higher levels of R&D and of specialisation in design, underlying the complementarities between modes of innovation. The configuration of creative industries is highly context-specific and strongly shaped by local conditions and assets. However, there are some common traits. The main asset of creative industries is talent. The organisation of production is varied, but generally involves a high number of self-employed, and thus relies heavily on institutional and professional associations and networks. This suggests an area where regional governments and agencies can play an important role.

Policies can shape innovation in creative industries by acting on the three major drivers of competitiveness in the sector. Those drivers are: *i*) people (by supporting the development of a creative workforce); *ii*) places (by shaping creative communities on the basis of local and regional strengths); and *iii*) production clusters (by fostering the creation of firms and institutions targeted to creative industries). However, to help regional governments support business development and creativity, it will be necessary to elaborate a new innovation measurement agenda and increase the capacity to measure innovation inputs, efforts and impacts.

# *Annex 1.A1*

### Box 1.A1.1. Typologies of European innovative regions

- **Metropolitan knowledge-intensive services regions:** 23 regions in densely populated metropolitan areas in Western Europe. These regions perform above average on absorption capability and average on both diffusion capacity and accessibility to knowledge. These regions show high rates of urbanisation and their level of economic performance is the highest of all regions. Many regions serve as their country's capital region.
- **Knowledge-absorbing regions:** 76 regions mostly in France, the United Kingdom, Benelux and Northern Spain. These regions show average performance on absorption capability, diffusion capacity and accessibility to knowledge. Their level of economic performance is just above average.
- **Public knowledge centres:** 16 regions, mostly in Eastern Germany and metropolitan areas in Eastern Europe. These regions show average performance on both absorption capability and diffusion capacity and above average on accessibility to knowledge. Their level of economic performance is close to average and economic growth has been strong.
- **Skilled industrial Eastern EU regions:** 44 regions in Eastern Europe. These regions perform below average on both absorption capability and diffusion capacity and average on accessibility to knowledge. They are rapidly catching up after low levels of economic performance.
- **High-tech regions:** 17 R&D-intensive regions in Germany, Finland, Sweden and the Netherlands. These regions perform above average on absorption capability, diffusion capacity and accessibility to knowledge. Their level of economic performance is above average.
- **Skilled technology regions:** 38 regions in Germany, Northern Italy and Austria. These regions perform average on absorption capability, diffusion capacity and accessibility to knowledge. Their level of economic performance is above average but their growth record has been below average.
- **Traditional southern regions:** 39 regions in Southern Europe (Portugal, Italy, Greece and Spain). These regions perform below average on absorption capability, diffusion capacity and accessibility to knowledge. Their level of economic development is below average and many regions rely on agriculture and tourism.

*Source:* Wintjes, R. and H. Hollanders (2010), "The Regional Impact of Technological Change in 2020", report to the European Commission, Brussels.

Table 1.A1.1. **Categorisation of OECD regions: group averages by variable**

| Category | Regions | High and medium-high-tech manufacturing (as % of total manufacturing) | Knowledge-intensive services (as % of total services) | GDP per capita | Population density | Business R&D expenditure (as % of total R&D expenditure) | GERD R&D expenditure total (as % of GDP) | Unemployment rate | PCT applications (per million inhabitants) | Tertiary education (as % of labour force) | % employment in primary sector | % of employment in public sector | % of employment in manufacturing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample average** | | 36.2 | 49.4 | 34 320 | **272** | 54.96 | **1.65** | 6.5 | **95** | 23.58 | **5.03** | 32.52 | 16.42 |
| **Knowledge hubs** | | | | | | | | | | | | | |
| Knowledge-intensive city/capital districts | 9 | 40.2 | 54.9 | **60 966** | 3 494 | 48.08 | 2.73 | **8.3** | 126 | 32.85 | 0.00 | 34.14 | **10.16** |
| Knowledge and technology hubs | 29 | 49.1 | 56.0 | 42 559 | **225** | 74.44 | 4.14 | 5.4 | 292 | 26.97 | 2.18 | 35.72 | 13.71 |
| **Industrial production zones** | | | | | | | | | | | | | |
| US states with average S&T performance | 38 | 43.1 | 54.0 | 43 799 | **51** | 58.75 | 1.60 | 5.2 | **97** | 17.79 | 3.16 | 39.47 | 9.57 |
| Service and natural resource regions in knowledge-intensive countries | 28 | 30.0 | 56.0 | 41 174 | **112** | 50.09 | 1.32 | 3.8 | **101** | 29.54 | **3.80** | 36.57 | 14.17 |
| Medium-tech manufacturing and service providers | 49 | 39.7 | 49.2 | 30 770 | **245** | 62.94 | 1.54 | 6.9 | **77** | 26.90 | **3.08** | 32.82 | 17.46 |
| Traditional manufacturing regions | 30 | 35.3 | 43.7 | 30 074 | **131** | 65.31 | **1.21** | 4.2 | **69** | 14.77 | **4.79** | 24.62 | 24.89 |
| **Non-S&T–driven regions** | | | | | | | | | | | | | |
| Structural inertia or de-industrialising regions | 38 | 27.3 | 42.9 | 24 070 | **111** | 35.04 | **0.83** | 11.0 | **22** | 23.88 | **6.67** | 29.82 | 17.25 |
| Primary sector-intensive regions | 19 | 20.0 | 41.0 | 16 429 | **99** | 33.24 | **0.53** | 7.5 | **4** | 18.59 | 19.09 | 23.58 | 20.26 |

Notes: Values noted in boldface have very large standard deviations. Latest available year used (generally 2007, but in some cases 2004, 2005 or 2006 depending on data availability). Due to a lack of sufficient sub-national data, the following countries were excluded from the analysis: Australia, Chile, Estonia, Iceland, Israel, Japan, New Zealand, Slovenia, Switzerland and Turkey. In addition, some OECD regions in countries used in the analysis were dropped due to missing data. They include the Yukon Territory (Canada), the Northwest Territories and Nunavut (Canada), Ceuta (Spain), Melilla (Spain), Åland (Finland), Corsica (France), Valle d'Aosta (Italia), Algarve (Portugal), Açores (Portugal), Madeira (Portugal).

List of variables: employment in high and medium-high-technology manufacturing (HTM) as a percentage of total manufacturing; employment in knowledge-intensive services as a percentage of total services; per capita GDP (thousands USD constant 2000); population density; business R&D expenditure as a share of total R&D expenditure; total R&D expenditure as percentage of GDP; unemployment rate; PCT patent applications per million inhabitants; tertiary education of the labour force (ISCED 5 and 6); share of employment in the primary sector: agriculture, hunting and fishing, share of employment in the public sector: public administration and defence, compulsory social security, education, health and social work, other community, social and personal service activities, private households with employed persons; share of employment in manufacturing: mining and quarrying, manufacturing, electricity, gas and water supply.

*Source:* Ajmone, G. and K. Maguire (forthcoming), *Categorisation of OECD Regions Using Innovation-Related Variables*, Regional Development Working Papers, OECD Publishing, Paris.

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# Part I

## *Chapter 2*

## Road maps and smart policy mixes for regional innovation

*Policies to promote innovation need to take into account the diversity in regional institutional structures and innovation potential, based on well-defined priorities and strategies. Strategic choices for regions depend on national development patterns and policies as well as the specific regional situation: frontier regions that are already capitalising on strong knowledge-based assets; regions that need to find a new development path due to exhaustion of past development models; or regions in a more difficult catching up situation. To implement strategies responding to these diverse conditions, a smart mix of policy instruments has to be developed. This mix should strike the right balance between the goals of knowledge creation, diffusion and absorption as appropriate for the regional context. The mix should also ensure synergies across individual instruments in view of their overall effectiveness.*

## Introduction

Throughout OECD member countries, policy makers are defining a greater role for regions in national and regional innovation policy. The discussion in Chapter 1 points towards diversity in regional potential and does not support a standardised "one-size-fits-all" approach around a single optimal model. The increasingly globalised context for innovation, and the vast differences in the way regions are connected to this global system, contribute to this diversity. Notably, while the available evidence supports a positive correlation between regional growth and investments in science, technology and innovation, this relationship is far from being linear or simple. Ultimately, it is the combination and interactions of many factors that make some regions better off, not only in economic performance, but also in terms of well-being and quality of life. Beyond traditional endowments in infrastructure, including "hard" and "soft" infrastructure in STI and education, many other factors are important, particularly since innovation goes beyond R&D. Elements of a virtuous regional trajectory might include: the quality and adaptability of the workforce; the capacity to attract and retain talent; development of high value-added production and services; the degree of entrepreneurship and creativity of the population; the demand for new products and services; and the quality of regional interactions and global connections.

The synergies between regional and national policies for innovation and regional development influence the dynamics of innovation in a given territory. Regional innovation policy is increasingly faced with demands to prove its effectiveness. If innovation matters for regional policy, and regions matter for innovation policy, what lessons can we draw from the policy experience in OECD regions and countries? Moving away from a "one-size-fits-all" approach, what patterns can help in assessing the relevance of regional strategies and the associated "policy mixes"? These questions lie at the core of this chapter.

## 2.1. Opening the black box of policies: identifying relevant policy spaces

Regions are increasingly relevant actors in innovation policy. But there are differentiating factors that justify more diversified approaches for innovation policies with a regional dimension. Regions do not share the same effective spaces for policy action in innovation. The relevant unit for promoting innovation may not be an administrative region. And there may be factors that limit the impact of innovation policies implemented at the regional level.

Three different perspectives are often considered independently with respect to regions and innovation policy:

- the **institutional perspective**, or margin of manoeuvre for regional institutions as defined by the national governance framework and the degree of devolution of power to the region;
- the **regional innovation system**, including regional strengths and weaknesses for innovative activities and system relationships shaping policy action; and
- the **strategic choices** made by regions for supporting the transition towards an innovation and knowledge-driven path.

While these perspectives each offer insights that can help determine the rationale and space for policy action, it is their combination that ultimately shapes regional innovation policies. They bring together both the strategy (i.e. priorities and objectives) and the lines of action (i.e. the composition and intensity of the policy mix). Taking all three dimensions into account simultaneously increases the complexity of regional innovation policies and calls for more sophisticated policy approaches.

The first step to adopting this multi-dimensional approach is the identification of the policy levers at the regional level. By opening the "black box" and closely analysing regional innovation policies, it is possible to identify, according to the policy objective, the kind of innovation activity and the agents involved, as well as the most effective space, scope and targets for regional action. This policy space will depend on the diversity of institutional frameworks, notably multi-level governance arrangements, and the variety of possible regional development strategies based on the identification of the region's strengths and assets. These factors influence the ways regional policy makers mobilise innovation capacity in their territories. That is the subject of this section.

The second crucial step is fixing the objective of the regional innovation policy itself. The strategy requires cross-sectoral approaches, recognising that major challenges are multi-faceted, and the setting of corresponding priorities. This policy objective results from the combination of national strategies, their relationship to the specificities of the region, and the specificities of the region's own innovation strategies. This will be the subject of the next section.

### *A variety of institutional arrangements*

The range and nature of competences devolved from central governments to the regions – both in general terms and as regards matters concerning innovation – is influential in shaping regional innovation policies. Austria, Belgium, Canada, Germany, Spain, Switzerland and the United States are examples of countries where regions have been granted broad autonomy, which they can use to implement innovation policy at the sub-national level. At the other end of the spectrum, regions in small or centralised countries such as Greece, New Zealand and Portugal are not expected to play as significant a role in innovation promotion in their countries.

The degree of decentralisation of public revenue, spending and investment across OECD member countries differs markedly, but are weak proxies for regions' freedom to act in innovation policy (see Chapter 3). Indeed, *i)* budgetary allocations may not necessarily coincide with decision-making power (budgets can be decentralised but decisions may remain at the national level); *ii*) the degree of decentralisation may be different for innovation-related matters than for more general policies; *iii)* different elements of innovation policy may have different degrees of devolved competences; and *iv*) some low-cost policies (such as regulations or catalytic actions) may have an important impact at the regional level. The incidence of innovation-related expenditures in regional accounts also varies among OECD member countries, due to differences in the administrative structure and to specific country strategies. The share of regional expenditure in total government budget expenditures on R&D, one part of innovation expenditure, varies even across federal countries, from around 5% in Austria to 50% in Germany to 79% in Belgium (see Chapter 3). In order to properly document this phenomenon, two directions need to be taken: first, budgetary statistics on GBOARD at regional level need to be developed, and second, better measures of public spending on innovation in the wider sense (beyond R&D) should be defined and collected, also at the regional level. OECD member countries are engaged in exploring the feasibility and methodology for collecting new data to adopt principles of the recently released OECD Innovation Strategy (OECD, 2010a). In the European Union, initiatives are also implemented to help collect better evidence on these policies, such as the Regional Innovation Scoreboard and the Regional Innovation Monitor.

Table 2.1 provides an overview of institutional variety across OECD member countries in relation to regional development and innovation. The table classifies countries according to: *i*) their institutional organisation (federal or unitary countries with elected regions or non-elected regional authorities); and *ii*) the degree of devolution of competences in science, technology and innovation (STI). As expected, regions in federal countries are generally accorded significant responsibilities in STI, but the situation concerning the other two categories (an elected regional tier of authorities and other unitary countries) displays a wider range in the level of responsibilities for innovation policy. Even in countries with no formal regional devolution of STI policies, there are cases in which regions still tend to develop regional innovation strategies. In some cases, regional innovation strategy documents have been adopted, but a lack of resources prevented their implementation. Clearly, the differentiation between the degrees of devolution of competences is more blurred in reality than depicted in Table 2.1. Nevertheless, this kind of taxonomy is instrumental when analysing and comparing the different policy choices.

Regions in two countries, enjoying similar types of competences, will in practice experience different margins of manoeuvre. This will depend on the direction and intensity of innovation policy carried out at the national level. The latter includes: the type and role of agencies responsible for policy design and implementation; their articulation with representatives from different levels of governments; and the mechanisms for co-ordination between different actions. These elements shape the intensity and direction of the national innovation strategy, the extent to which the national vision is an expression of regional priorities and, thus, influences the margin of manoeuvre for regions. Ideally, a high degree of complementarity and coherence would need to be achieved between the two levels of policies. For example, public-private organisations for technology and innovation can be created and funded solely by regions, as is the case in Spain or Belgium, and often with a goal of attracting additional national or supra-national financing sources to the region. Alternatively, such initiatives may originate at the central level, with regions participating and co-financing, such as for the competitiveness poles in France or centres of expertise in Finland.

Table 2.1. **Decentralisation of powers for science, technology and innovation (STI)**

| Degree of devolution in STI policy competences and resources | | Federal countries | Countries with elected regional authorities | Countries with non-elected regional level/decentralised state agencies |
|---|---|---|---|---|
| Significant control of STI powers and/or resources by regions | | Austria, Belgium, Germany, Australia, Canada, Switzerland, United States, Brazil | Italy, Spain, United Kingdom (Scotland, Wales, Northern Ireland) | |
| Some decentralisation of STI powers and/or resources to regions | | Mexico | France, Netherlands, Poland, Sweden (pilot regions), Norway, Denmark (autonomous regions) | United Kingdom (English regions), Korea<br>Sweden (except pilot regions) |
| No decentralisation of STI powers | Regional innovation strategies | | Denmark, Slovak Republic, Turkey, Czech Republic, Portugal (autonomous regions) | Hungary, Ireland,<br>Portugal (mainland) |
| | Innovation projects only | | Chile, Japan | Greece, Finland, Luxembourg, Iceland, New Zealand, Slovenia |

Note: The degree of devolution of competences in innovation-related matters is subject to change. Information reported in this table refers to the first semester of 2010.

*Source:* Adapted and expanded from Muller, E., C. Nauwelaers *et al.* (2005), "Enlarging the ERA: Identifying Priorities for Regional Policy Focusing on Research and Technological Development in the New Member States and Candidate Countries", report to DG Research, Brussels. With additions from ERAWATCH and OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris (see Chapter 3).

### *Different types of innovation potential across OECD regions*

The variety in the innovation potential of regions derives from different production structures and development paths. It is also related to the balance between different types of innovation actors (small or large, domestic or multi-national firms, degree of integration in value-chains, etc.) and the accumulated capacities and potential for knowledge creation, diffusion or exploitation. The nature of global and regional linkages, as well as geographic position and accessibility, are also relevant. This diversity encompasses both qualitative and quantitative aspects.

On the **qualitative side**, the literature on regional innovation systems (RIS) has detailed the large variety of innovation models. The RIS approach offers two major contributions to the innovation policy debate. On the one hand, it highlights the heterogeneity and differences within countries. On the other hand, it helps illuminate the dynamics of innovation in a given system, and identify the diversity of determinants of regional innovation, thus offering a relevant framework for designing policies. In fact, the RIS approach calls for a systemic and broad policy perspective (strengthening of human capital, demand-side policies, policies for research and creativity, policies for industrial innovation, etc.), and for tailoring the policy mix according to the specificities of the region and its production system.

However, the RIS approach is only a broad framework and does not provide a recipe for policy. First, it is difficult to generalise policy recommendations, as each situation tends to be described as unique. Second, when interpreted too narrowly, it may lead to inward-looking and biased policy approaches. A regional innovation system is not simply a smaller national innovation system, and the regional administrative boundary is not necessarily the relevant space for the dynamics of knowledge generation and innovation. Cross-border regional collaboration within and between countries matter for innovation. Overlooking this might lead to policies focusing excessively on strengthening the linkages within regions, while neglecting outward linkages.

On the **quantitative side**, available comparative data have been used to characterise the diversity in regional innovation potential (see Chapter 1). The taxonomies of regions, aiming to identify heterogeneity in regional innovation structures and innovation potential, can be useful for policy analysis. The drawback of quantitative studies is that available indicators tend to measure intensity of knowledge creation, rather than other forms of innovation. Failing to understand the limitations of this data can lead to an inappropriate emphasis on this one aspect of the innovation system when developing policy orientations. Despite the fact that the indicators used do not capture all relevant aspects of regional diversity, the picture at least shows how much innovation potential differs across regions, even in the same country, and calls for adapted policy responses.

Another important feature, described in Chapter 1, of regional innovation systems is that scientific and technological activities tend to agglomerate in space. However, countries differ in regionalisation patterns of innovation activities in their territories, both according to the specificities of the activity in question (i.e. aircraft production and textiles clearly show different regionalisation patterns) and to the institutional frame, which influences the development of the national innovation system. Most regional innovation system analyses tend to focus on identifying heterogeneity between regions in terms of endowments and potential for innovation, underplaying the country dimension. Given that all countries tend to show a concentration of innovative activities in given locations, the relevant question for policy is the level of regional disparity in innovation investments that a country can support without compromising aggregate performance.

### *Diversity in regional development and innovation strategies*

The devolution of competences to support regional development creates an institutional space for setting priorities and mobilising actors in support of innovation. EU Structural Funds offer a good example of a mechanism through which regions are requested to explicitly define priorities and design policies to access funds. Since the mid-1990s, the EU has continuously sponsored strategic exercises in regions with the aim of improving the quality of policy making. These efforts resulted in a large sample of case studies, methodological guides and thematic analyses (European Commission, 2004; Oughton *et al*., 2004). This pool of experience is available for regional policy makers, but experience is difficult to transfer from one regional environment to another. In some countries, the national government explicitly supports the development of regional innovation strategies. For example, the Vinnväxt programme in Sweden launched a competition among regions for the development of innovation strategies. In France, a methodological guide and coaching for regional innovation strategies was developed at the central level (ADIT, 2007). The UK government provided incentives for the English regions to develop their own regional innovation strategies early in the 2000s (OECD, 2008a). Looking forward, the European Commission is planning to set up support services to regions engaged in developing smart specialisation strategies.

Practice shows that availability of resources and an explicit mandate to elaborate a strategy are necessary, but not sufficient, conditions for empowering regions to implement them. The capacity to design innovation strategies is highly influenced by the institutional infrastructure at the regional level. The quality of the policy process, the availability of evidence to inform the choice of priorities, and the participation of regional stakeholders are all key issues influencing the effective capacity to elaborate and implement policies for knowledge-based regional development. Indeed, over-reliance on external support for developing regional innovation strategies can be counterproductive in reducing self-awareness and commitment among regional stakeholders. Investment in policy-making capacity helps to address the institutional capacity gap at the regional level, a key challenge. Networks and communities of practice among regional policy makers, within and between countries, also build regional capacity.

## 2.2. Recognising challenges and setting priorities

The last dimension of heterogeneity between regions – diversity in development strategies – raises the crucial question of prioritisation within innovation policy. Innovation is not an end in itself, but a means to achieve development objectives. Hence, a road map for innovation policies for regions should identify the main challenges and opportunities for regional socio-economic development as well as be translated into key priorities for policy action. These policies are context-specific and constrained or enhanced by a given region's potential.

Strategy setting is a complex task that requires not only commitment from all the actors of the innovation system, but also political courage in selecting priorities and setting targets. The strategy needs to be based on evidence and engineer information coming from multiple sources. In the last decade, there was a generalised consensus in OECD countries on a major policy target: increasing R&D expenditures. Recently, there has been a growing recognition of the need to explicitly address other dimensions of innovation that influence not only the rate of introduction of new products and processes, but also their direction. Innovation policy is increasingly called on to address societal and environmental challenges, thus adding sustainability to the traditional considerations of price and technological competitiveness. The direction of technical change has become even more important than its intensity.

The double paradigm shift increases the relevance of innovation strategies and the responsibility of agencies responsible for setting strategy, at both national and regional levels. The territorial approach enters into the new innovation paradigm in two ways. The first is the rising concern for regional and spatial dynamics of innovation in national policies. The second approach comes from the regional strategies put in place by regional authorities to address their specific sustainability and development challenges.

### *National innovation strategies and regional development*

When including territorial considerations in innovation strategies, authorities are confronted with a dilemma. On the one hand, this approach could help increase growth in a more balanced way, boosting aggregate productivity through increases in the majority of lagging areas. On the other hand, the dispersion of efforts could be detrimental for supporting national innovation champions, since concentration of resources and infrastructure are needed for economies of scale. Scepticism about decentralisation for innovation is attributable in part to several policy failures of mass infrastructure investments in peripheral locations, resulting in the famous "cathedrals in the desert". These policies ended up in the creation, and subsequent decline, of research infrastructure in locations with weak backward and forward linkages and little capacity to attract talent. This tension between territorial balance and concentration, however, was exacerbated by the prevailing supply-side focus of such projects. Nowadays, innovation policies include a broader set of actions, such as specific support to enhance absorptive capacities in firms or knowledge diffusion. Well-thought-out strategic investments, focused on constructing and developing regional-specific advantages, may prove successful even in non-core regions if they are clearly linked to economic activities with growth potential. Innovation policies can therefore be used to support more balanced and inclusive growth patterns.

Differences in national institutional and territorial administrative structures shape sub-national policy spaces. The historical development pattern of a given country and its geographical configuration also influence the spatial approach to innovation. A brief overview, starting from more to less experienced innovators, illustrates this diversity.

The models for experienced innovator countries range from top-down to hybrid to complex, multi-level institutional arrangements. Germany and the United States are examples where innovation support is managed by both national and regional levels. The Japanese innovation model has been strongly linked with industrial development and followed a more top-down approach in creating capabilities in key strategic industries. The regional component appeared in national strategies, especially for cluster policy. Cluster development in Japan followed two parallel tracks: the first, beginning in 2001, prioritised the creation of industrial capabilities and was led by the Ministry of Economy, Trade and Industry (METI) and its provincial peers. The second, initiated in 2002, fostered innovation and was managed by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and its provincial peers (OECD, 2007). The role of regional authorities in STI remains much more limited in Japan, compared to the role of German *Länder*, for example. Some other advanced countries follow a more centralised innovation policy model, such as France, Sweden and the United Kingdom.

Some middle-innovative countries are characterised by somewhat lesser developed national innovation policy visions, but also have fairly active sub-national actions. Italy and Spain, for example, have strong sub-national action to sustain the development of successful production and knowledge clusters. The north-south disparity is a well-known and persistent characteristic of the Italian socio-economic system. Italy invests few resources in R&D but displays good capacity in non-R&D-based innovation in sectors such as creativity and design. To overcome the lack of critical mass in the investments for STI, a recent national policy document calls for additionality between national and EU Structural Funds for innovation investments in a territory. Recent trends also point to an improvement of the dialogue between regional and central authorities, including a "State-regions" conference to favour additionality in strategies and behaviours (MISE, 2009). Spanish regions have promoted policies for scientific knowledge creation and/or technology diffusion adapted to local industrial clusters. National policy also recognises explicitly the territorial dimension. For example, one of the five axes of the new national innovation strategy "E2I" is regional co-operation (OECD, 2011a).

Successful instances of more recent knowledge-based development include both centralised and balanced development approaches. The Finnish approach used a more centralised model, while Korea's formerly centralised approach has opened to mobilise innovation for more balanced growth. Finland recently carried out an evaluation of the Finnish innovation system, highlighting the tension between the supporters of a science-led model, which favours resource pooling for excellence and spatial concentration, and those advocating a more balanced development approach (MED and MEE, 2009). As mentioned above, the two views are not necessarily contradictory, but the type of innovation targeted in various places differs. An interesting approach is to empower regional actors to allow experimentation of promising avenues in specific innovative niches. This choice requires a strong political commitment both on national strategy and on the generation of mechanisms for allowing policy learning and adaptation for successful experimentation.

Korea is a well-known and successful example of catching up through the creation of knowledge-based capabilities. It did so through a mix of education, innovation and industrial policies that allowed rapid industrialisation (see Box 2.1).

### Box 2.1. **Korea: a successful case of catching up**

In the 1970s, the aggregate productivity of manufacturing in Korea was inferior to the aggregate productivity of manufacturing in Latin America. In less than 30 years, the country was not only able to leap-frog Latin America but reach the productivity levels of the technological frontiers, i.e. the United States (Cimoli, 2005). However, the economy suffers from a high concentration of economic activity in the Seoul metropolitan area, thus creating imbalances and tensions. In fact, 40% of public research institutes and universities and around 60% of business research units are located in the Seoul metropolitan area. The structural and social conditions among the 16 Korean provinces are extremely diverse. Since 2000, Korea has considered marginalised provinces as potential poles for accelerating aggregate productivity growth. The country started to use innovation policy tools to promote a more balanced development pattern, following a competitiveness-based regional development approach rather than a compensatory strategy. The Comprehensive Regional S&T Promotion Plan of 2004 aimed at creating regional competences in strategic technologies as well as regional centres for innovation, supporting the strengthening of human resources for S&T, and providing incentives to increase provincial level expenditures in R&D. The Third Comprehensive Plan for the Promotion of Regional S&T (2008-2012) aims to create mechanisms for supporting innovation following a more balanced territorial approach. The government strategy includes the commitment of increasing provincial-level spending in R&D, national investments in the creation of research centres and clusters beyond the Seoul area (OECD, 2009a).

Economies such as those of Australia, Chile and New Zealand are currently building their knowledge base. These countries show a growing interest in the regional dimension, coupled with a policy paradigm shift towards a renewed and more pro-active role of the State in support of innovation. New Zealand, for example, started to introduce a regional development perspective in innovation policy at the end of the 1990s. In Chile, the regional perspective in innovation policy mostly coincided with a cluster development agenda, and requires institutional improvements to empower regional agents to be relevant actors in innovation (OECD-IADB, 2009).

Large emerging countries such as Brazil and China are moving towards broad innovation agendas, with a clear priority on sector-specific national actions. At the same time, those countries implement a set of policies to boost competitiveness and growth in peripheral areas, with the aim of supporting higher and more balanced growth to reduce destabilising regional disparities. The Brazilian national science, technology and innovation strategy combines: a selective approach strictly linked with support for production development; a commitment to increase the quality and critical mass of skilled human resources; and an increasing focus on the regional dimension. The Ministry of Science and Technology supports the proposal and approval of innovation laws in Brazilian states to create the legal basis for state-level action in innovation-related matters. Several initiatives have been carried out to increase decentralisation in the provision of support to innovation, and incentives have been designed to support matching federal, state and private resources for innovation (MCT, 2007; CGEE, 2010). China's provinces, while supporting different national five-year plans, do have the resources to promote regionally adapted approaches. National policies are also promoting balanced regional development more generally, with S&T now emerging as a consideration in this development approach (OECD, 2008b).

The role of regions in national innovation policies varies (see Table 2.A1.1). Even when their competences are limited, they can act as experimental policy laboratories, such as in the Netherlands or Finland. Regional experience can contribute to national policies or be confined to passive implementation, as in the Czech Republic or Ireland. In the former case, this does not exclude region-specific innovation promotion initiatives, often in the area of business or start-up support. At the other end of the spectrum, regions with strong competences can be leaders, as in Belgium; may initiate the development of knowledge hubs, as in Germany and the United States; or be active mostly in technology diffusion initiatives, as in Italy and Spain. In Switzerland, the cantons have a restricted role in innovation policy, apart from their responsibilities in funding universities. Between the two extremes, regions in centralised countries such as France, Sweden and the United Kingdom not only implement national policies but are taking a more active role in formulating bottom-up innovation strategies. In Sweden, the role of regions is not equal, as some regions are more active than others in developing innovation strategies within the same national frameworks.

There is no strict correspondence between the length of a country's history in innovation policy and the level of regional involvement in this policy field. The institutional powers of regions are important, but governments in centralised countries can find ways to encourage regions to experiment in innovation support even when these powers are limited. Conversely, regions with strong institutional powers are not necessarily at the forefront of innovation policy in their country. By fine-tuning governance mechanisms, a region's potential for innovation can be better exploited for overall development. To promote balanced development and the creation of knowledge capabilities, sophisticated policy approaches are needed for strategy setting and policy design at all levels. This demands articulated efforts between levels of government for the design of policies and initiatives that support the creation of innovation capacities beyond "islands of excellence". Territorial considerations in innovation policies should supplement, not supplant, national efforts in pursuing excellence in research and generating technological and knowledge capabilities. Representative institutions at the sub-national level can help inform national strategy because they have a fuller understanding of a region's potential.

### *Variety in regional strategies: policy options*

Many regional authorities develop policies in order to act as critical agents of change by supporting virtuous innovation processes. Their capacity to act is determined by their institutional position, the region's potential and the nature of the strategic choices underpinning policies. The region's task is to develop a vision for regional development, mobilise actors around it, and implement the appropriate policy mix to support the vision (see section 2.3 for a discussion on the smart policy mix). Past and present experience of OECD regions reveal that regions face three main types of choices, with three corresponding families of strategies:

- **building on current advantages** (science push, technology-led, or a mix);
- **supporting socio-economic transformation** (reconversion or identification of a new frontier); and
- **catching up**: towards the creation of knowledge-based capabilities.

This broad classification of strategies corresponds with the categorisation of OECD regions (see Chapter 1). While such a quantitative classification of regions is limited by the data used, it does highlight possible strategic choices to support innovation-led development. OECD knowledge hub regions must decide how to build on their current advantages. Industrial production zone regions need to support socio-economic transformation by increasing diversification or identifying new drivers for competitiveness. Meanwhile, non-S&T-driven regions need to foster the creation of knowledge-based capabilities and increase the density of their linkages with other regions.

### *Building on current advantages (science push, technology-led, or a mix)*

Some regions, at a given moment in time, benefit from key knowledge and technology endowments. Dominant in current technological paradigms, these regions have accumulated capacities and are usually well placed to progress to the next frontier. This is the case for California (United States), the Montreal region in Quebec (Canada), Baden-Württemberg (Germany), the Fukuoka region (Japan), or South Netherlands for example. These regions have a variety of strong firms, private or public research centres, and competence centres acting in public-private partnership mode, all active in creating and exploiting new knowledge. They face the challenge of reinforcing their leadership in particular sectors, and in maintaining their high standard of living. A key question for regions in this position is how to build on current advantages while leaving room for experimentation and diversification into future models (Box 2.2).

### Box 2.2. **Strategies of innovation leaders: building on current advantages**

The **Fukuoka** region in Japan actively promotes R&D and innovation. Its policy mix is extensive, providing support mainly to knowledge generation and exploitation. The Fukuoka Cluster for Advanced Systems LSI (large-system integrated) Technological Development benefits from the accumulated capacities of universities and firms related to the semi-conductor and automotive industries. It supports the creation of world champions in LSI technologies in order to serve the Silicon Sea Belt region that connects Fukuoka (Japan), Gyeonggi (Korea), Beijing (China), Shanghai (China), Hsinchu (Chinese Taipei), Hong Kong (China), Singapore, Bangalore (India) and other East Asian regions, accounting for around 50% of the global semiconductor manufacturing industry. The Fukuoka region plays an active role in supporting the current regional strengths. In 2001, a plan for supporting the development of the world hub in LSI was developed on the basis of a partnership between universities, business associations, firms and regional and national government agencies. The plan has a broad approach and supports activities including human resources development and incentives for networking and collaboration. The region benefits from a pole of human resources formation through the Kitakyushu Science and Research Park and the universities of the Iizuka area. The region also hosts one of the major ICT-related science parks, the Fukuoka Soft Research Park. The park employs 10 000 people and hosts 200 foreign and Japanese companies, as well as major research institutions. In addition, the region also offers ample public support for venture business through the Fukuoka Venture Market (FVM) and investment and promotion by the Kyushu Venture Partners 1 (KVP1), etc.

The **Dutch Province of Noord Brabant** is part of the South Netherlands region, a global knowledge hub. The province is one of the most knowledge-intensive regions in Europe. The area around the city of Eindhoven, nicknamed "Brainport", is among the most R&D-intensive. It includes high-tech companies, such as Philips (the dominant R&D actor); the world's leading wafer-stepper manufacturer ASML (machines for making chips); a large machine industry conglomerate (the VDL group); a medium-sized chip manufacturer (NXP) and a leading truck manufacturer (DAF Trucks). Regional and local authorities have established a large incubator around Philips' R&D laboratory, which hosts several thousand knowledge workers. Leading sectors have been identified as part of the national "Peaks in the Delta" initiative to support regional strengths: Brainport is one major Dutch "peak". The present policies in Brabant are to a large extent influenced by Philips. Philips decided some ten years ago to reduce its fundamental research activities and focus on its core competences, proposing to open up its research campus and create an "open innovation" high-tech campus that welcomed many outside companies. The campus is now one of the Netherlands' innovation and research hot spots, a centrepiece in national and regional policies. For 2010, the budget to support the Peaks in the Delta programme was EUR 9 million. In the Eindhoven region, an attempt is underway to systematise fragmented and overlapping support for innovative start-ups. This is also the impetus behind the national Technopartner programme, a good example of a policy designed to combine or mix a number of formerly disparate policies aiming to encourage innovative start-up and spin-off companies. The programme promotes different actors that provide diverse, but interrelated support for formalising a partnership that includes a package of relevant incubation services and resources.

### Box 2.2. **Strategies of innovation leaders: building on current advantages** *(cont'd)*

**Baden-Württemberg** (Germany) is one of the most research-intensive regions in Europe, according to all types of indicators: share of labour force in high-tech manufacturing, patent intensity (patent applications per million inhabitants and R&D expenditures as a percentage of GDP (4.4% in 2007). This is also true in absolute terms. Given its size (11 million inhabitants), R&D investments in the region exceed those in countries such as Finland and Sweden and even approach that of Italy. More than 80% of the regional R&D activities originate in the business sector. The research infrastructure is very strong: 9 universities, 10 colleges of art and music, 23 state universities of applied sciences, 6 colleges of education, 8 professional academies and numerous state-accredited private higher education institutions. The non-higher education sector comprises a large number of research institutions active in basic and application-oriented research. The regional economy is specialised in the automotive, mechanical, engineering and pharmaceutical industries. As a federal state, Baden-Württemberg has both the legal and economic power to run a comprehensive and ambitious research and innovation policy in its own right. The region's research and technology policy focuses on fostering close co-operation between the science, business and political sectors. Within the state government, research policy initiatives and projects are co-ordinated with technology policy measures for innovation support, as well as education and further training. The state government funds research in universities and non-university research institutions in a wide range of fields, with a focus on both breadth and depth. Important principles and priorities of research and technology policy in Baden-Württemberg include: priority for scientific excellence; development of public-private partnerships and co-operation; strengthening openness to innovation in companies; and securing human resources for research and innovation.

**The Montreal region in Quebec** (Canada) is the sixth major player in the world aerospace industry, after the United States, France, the United Kingdom, Germany and Japan. Quebec accounts for 50% of Canada's aerospace workforce. The Montreal region has the world's largest concentration of aerospace industry activity. Companies producing all the components for new airplanes are located within 30 kilometres. The industry offers many employment opportunities, accounting for 1 out of 190 jobs in Quebec, and 1 out of 95 in the Montreal region. However, competition from emerging global players is forcing some firms to reconsider their operational models, putting pressure on the cluster to come up with new organisational structures and collaboration arrangements. The public sector plays a determinant role in supporting R&D and infrastructure for innovation, with well-articulated co-ordination between the government of Canada (technology and industrial development support/knowledge generation) and the government of Quebec (which is mainly concerned with investment, research infrastructure, capacity building, and knowledge diffusion and exploitation). Most large companies have internal R&D departments; however, the contribution of the public sector in supporting innovation is crucial for multiplying the effect, creating synergies with private efforts and helping small companies invest in innovation. The state benefits from federally targeted financing schemes (subsidies and refundable credits) for innovation in aeronautics. Federal support is complemented by provincial financing to firms such as the FTQ (*Fonds de solidarité des travailleurs du Québec*), whose major objective is to contribute to employment generation in the province by supporting SME development. The regional action also helps in defining the creation of a shared vision for the evolution of the aerospace industry and Quebec's role in it. The industry has expressed a strong demand for: continued government support for research; increased capacity in attracting foreign investors; development of stronger links with foreign players in the industry; establishment of projects overseas; support to R&D in SMEs; improvement in management capacities in companies; and reduction of foreign content in finished products.

*Sources*: CMM (*Communauté métropolitaine de Montréal*), 92004, Aerospace Cluster, Quebec ; Regional Innovation Monitor, *www.rim-europa.eu*; Wintjes, R. (2007), "Monitoring and Analysis of Policies and Public Financing Instruments Conducive to Higher Levels of R&D Investments: The 'Policy Mix' Project: The Case of the Netherlands", report for DG Research, *www.policymix.eu*.

### *Supporting socio-economic transformation (restructuring or identification of a new frontier)*

After a history of successful and promising development, many regions find themselves under threat when their development model begins to fail. Many regions are likely to seek this strategy, as implied by the category of OECD industrial production zone regions. Some examples include regions highly specialised in textiles, such as those in Italy, whose sustainability is threatened by Chinese competition. Traditional industrial regions that have opted to pursue high-tech and high-knowledge content production also face this competition, like the Nagano province in Japan, Nuevo León in Mexico and Lower Austria. Regions formerly dependent on traditional automotive or naval industries are finding it necessary in the current global economy to reconfigure their socio-economic profile. Examples include Piedmont (Italy) and the Detroit area (United States), both affected by transformation of the car industry, and Bremen (Germany), which was heavily dependent on the naval industry. Another example is the Basque Country in Spain, which underwent an initial transformation in the 1980s and is now pursuing a broader strategy promoting its technical competence and diversification into new sectors (Box 2.3.).

Such regions need first to recognise the relevance of transformation and identify a new frontier. A second step is to identify possible transformation vectors: attracting human capital; fostering productive use of regional traditions and knowledge; identifying potential partnerships in national strategies, etc. The process is highly context-specific, and there are no blueprints valid for all cases. Sometimes, new directions are suggested by entrepreneurs with the vision and ability to create positive backward and forward linkages both regionally and internationally. Regions can help by nurturing an environment conducive to experimentation and offering instruments that encourage new development and production models. One such example is the Italian Slow Food movement, which promotes linking production, consumption, distribution and training in the food sector with ethical and "value-led" behaviour. Another strategy is to build on existing skills in generic technologies to develop unique and original activities and, in the longer term, entirely new sectors. This is often referred to as the "smart specialisation" approach (Foray and Van Ark*,* 2007). The Rhône-Alpes region, for example, exploited traditional skills and market knowledge in textile industries and a knowledge base in chemistry and engineering technologies to develop its technical textile sector. Smaller-scale experiments, such as the Toronto Hydrogen Village (Box 2.3), can offer a fruitful start for new trajectories.

### Box 2.3. **Strategies for socio-economic transformation: restructuring and identifying new frontiers**

The **Basque Country** in Spain is regarded as a regional success case in which a traditional industrial manufacturing area was repackaged as an attractive and dynamic destination. The "Guggenheim" effect, building on the construction of the new art museum, redefined the image of Bilbao, boosting regional commerce and services. This was only a first step, since industrial activity remains a major source of employment in generating wealth for the region. It also provides a reserve of expertise in industrial production and the organisation of economic activity. The Basque Country has also identified an apparent "missing link": its research base. It recently began prioritising a series of governmental actions to strengthen the regional research base and its human capital. Regional industrial production is being retooled to keep pace with changing paradigms, to take advantage of the opportunities offered by the global knowledge economy, and improve the region's standard of living. Certain assets of the Basque Country have helped to shape the search for the new frontier. Its history of manufacturing and production suggests development of research capacities and investment in the generation of new knowledge. The inward orientation of certain aspects of the regional innovation system calls for selectively improving international collaboration and linkages for innovation, as well as investing in the training, attraction and retention of skilled workers.

The **Shinshu** Smart Device Cluster in Japan contributed to the transformation of the Nagano Prefecture from a traditional industrial area to a high-tech-intensive industrial pole. The objective is to support industrial development with a view toward creating new jobs. The development plan followed a two-step procedure. A first phase centred on the Knowledge Cluster Initiative programme, started in 2002, fostered R&D in key technological fields, such as high-precision processing technology, precision-moulding technology and engineering design, all building on the engineering expertise of Shinshu University. The second stage, started in 2007, involves the creation of the Shinshu Smart Device Cluster, which fosters the establishment of high-tech firms and the commercialisation and diffusion of research. The programme is the result of a combination of strong political will at the provincial level, well-organised support from the national government, and strong commitment from the business and research sector. By 2007, the cluster included 319 firms, 106 research members and 121 supporting organisations.

**Nuevo León** in Mexico is another example of a traditional manufacturing area turning towards a more knowledge-based economy. Compared to other regions in Mexico, it has a strong background in technological research, a skilled labour force and a comparative logistical advantage. The region is prioritising four main sectors: ICT, biomedical devices, food technologies and aerospace, as well as supporting existing clusters, for example, the automotive industry. The state provides a series of incentives for knowledge-based firms, including some innovative selection criteria, increasing support for firms that pay higher salaries to their workers.

### Box 2.3. **Strategies for socio-economic transformation: restructuring and identifying new frontiers** *(cont'd)*

**Piedmont**, a traditionally wealthy and moderately industrialised region in Italy, recently embarked on a diversification strategy. It focuses on the ICT sector and revitalisation of regional business practices, as well as emphasises international collaboration to go beyond regional partnerships. Piedmont's economic structure consists of large firms connected to a network of small and medium-sized firms operating in the automotive, aeronautics, agro-food and textile industries. The region needs to prioritise industrial reconstruction and job creation as well as identify opportunities for knowledge-based advantages. It has several strengths, including the accumulated expertise of firms and regional entrepreneurs, and its strong research base, with a mix of universities and polytechnic schools. This rich institutional infrastructure provides opportunities for cross-fertilisation between research and production. However, the region's capacity to transform itself will depend on balancing public support and bottom-up experimentation of firms. Since 2005, the region has focused on strengthening its research base and invested in promoting innovation networks and supporting SMEs. To support the search for a new frontier, the region instituted two major activities: *i)* forming committees and forums where stakeholders can exchange views and move towards agreement on innovation policy; and *ii)* an outreach strategy supporting a functional rather than a place-based approach to innovation. The goal is to implement new policy instruments that not only identify regional actors but offer support to any provider, regional or foreign, that can help address selected issues in regional development.

**Lower Austria (*Niederösterreich*)** is a region with a moderate high- and medium-tech specialisation, surrounding the knowledge-intensive region of Vienna and bordering the new EU member countries of the Czech and Slovak Republics. This geographic situation raises several issues. The proximity of Vienna can undercut regional resources. The proximity of new member countries offers regional companies new markets, but also threatens to put pressure on jobs, given the availability of lower cost labour. Lower Austria's main development challenges lie in developing more value-added and innovative activities, especially within the more traditional regional sectors. Regional innovation is seen as a response to the above challenges. The regional authorities have intensively reworked their priorities in a series of strategic exercises carried out since the mid-1990s. The region's innovation strategy now observes the following priorities. *i)* **Knowledge exploitation:** a main regional tool is the development and fine-tuning of an extended network of business support and advisory services, helping regional SMEs access knowledge and develop innovative strategies. The funding of "innovation assistants" in companies addresses one bottleneck, a lack of appropriate human resources in smaller companies. A wide range of support services are also available for new firm creation: incubators, seed capital and "soft" support. *ii)* **Knowledge diffusion:** the aim is to ensure linkages with the knowledge-intensive Vienna region, and insert regional actors in wider regional networks. Technology centres have a technology transfer mission. The innovation assistant programme not only improves absorptive capacities in companies, but also helps them in creating linkages with a graduate's university of origin. *iii)* **Knowledge generation:** despite low regional budgets for R&D and technology compared to the national level, the region is intent on developing technology sources, for example by establishing competence centres.

### Box 2.3. **Strategies for socio-economic transformation: restructuring and identifying new frontiers** *(cont'd)*

Regional governments can play a decisive role in promoting new economic and technological frontiers. This includes mobilising different actors and helping to address problems at different stages, from idea conception to application and dissemination. In Canada**,** the **Toronto Hydrogen Village** involves more than 35 companies and includes developers and end users. The programme is administered by the Canadian Transportation Fuel Cell Alliance (CTFCA) and receives financial support from the Ontario Ministry for Research and Innovation and the CTFCA programme of the Canadian National Research Council (NRC). The project aims to create the conditions for early development in supply and use of green energy in the Greater Toronto Area (GTA). The programme has a comprehensive approach and includes: direct support to technology development; creation of a sustainable and effective infrastructure for energy delivery; increasing awareness in the community through supporting social corporate responsibility; codes, standards and regulations for sustainable development; and increasing public awareness through educational institutions and the media. The programme counts on the membership of public institutions from different levels of government, such as the City of Mississauga, Toronto, the government of Ontario, and federal energy and innovation institutions and associations. The programme finances activities developing the supply chain, in fuelling infrastructure (production, storage and delivery) and in end-use technologies. As an incubator for solutions to implement new green energy sources, it benefits from an integrated approach, ranging from support to technological research and development; support to demand generation for new products, services and application and a shift towards more sustainable consumption and production choices. The provincial and metropolitan dimension, matched with federal funding, allows for this experimentation. Results and application are envisaged in the mid-term through close interaction with the end-user community in the GTA. Its task is to give continuity to government support, identify better mechanisms linking federal and provincial actions, and formulate mechanisms for transposing the demonstration activities to a larger scale.

*Sources*: Coordinación de CyT del Gobierno de Nuevo León, *www.nl.gob.mx*; OECD (2011), *OECD Reviews of Regional Innovation: Basque Country, Spain*, OECD Publishing, Paris: doi.org/10.1787/9789264097377-en; OECD (2009), *OECD Reviews of Regional Innovation: Piedmont, Italy,* OECD Publishing, Paris, doi: 10.1787/9789264039162-en; OECD (2009), *OECD Reviews of Regional Innovation: 15 Mexican States*, OECD Publishing, Paris, doi: 10.1787/9789264060135-en.

## *Catching up: towards the creation of knowledge-based capabilities*

The most challenging strategies concern regions that lag behind in income per capita, productivity growth and employment generation. A significant number of OECD regions need to formulate a strategy to catch up and to create knowledge-based capabilities. They do not currently operate in a science-and-technology-driven model of growth. Almost all advanced countries include lagging regions that need to raise standards of living, quality of life and provision of services. These regions suffer from the absence of high value-added economic activities and a general lack of infrastructure and high-quality services.

The experience of successful catching up cases can offer some guidance here, although the evidence is mixed. There are cases, most notably in big emerging economies, in which strong governmental action to promote the creation of knowledge and technology poles has revitalised regional development: the case of the ICT cluster in Bangalore (India); the creation of the biotechnology pole in Minas Gerais (Brazil); and the transformation of the Pudong New Area on the east side of Shanghai (China), from a poor farmland zone in the early 1990s to a contemporary world-class biomedical research hub. If a lesson can be learned from these diverse examples, it is that each involved strong public support through traditional S&T policies but also infrastructure, production development, innovation, education and other complementary policies. In addition, these successes depended on a strong national innovation strategy that required negotiation with regional authorities. In other cases, leading scientists, entrepreneurs or firm-level initiatives have galvanised regional development dynamics, and public support has followed after the fact. In other instances, a region's advances may be due not to a purely regional innovation strategy, but to complementarities and synergies with neighbouring regions. This occurs in the case of the de-regionalisation of big national companies, in which certain areas benefit from positive externalities of rising demand and supply patterns of other regions.

For these catching up strategies to work, there is a need for knowledge absorption capacities and skills in the targeted region. The typical challenge faced by governments wishing to initiate or support catching up processes is avoiding the creation of dual economies, where only a restricted part of the economic fabric is thriving, while the rest remains in a state of underdevelopment. Supporting the creation of regional growth poles is a first step towards a successful catching up strategy, but it can be difficult to generate spillover effects across the wider regional economy. A bias towards supply-side measures is a common trait of policies with relatively weak impacts. The way forward is to focus policies on increasing absorption capacities, most notably by investing in human capital development (Box 2.4). Regional catching up processes usually require a mix of incentives matching national development strategies. Catching up is a systemic phenomenon that cannot be dealt with only from the regional perspective.

### Box 2.4. **Strategies for catching up: avoiding a supply-side bias**

**Wielkopolska (Greater Poland)**, with a population of 3.4 million inhabitants, is one of the richest regions in Poland, after the Warsaw region (*Mazowieckie*) and Slaskie. Nonetheless, the intra-regional disparities are still significant. While Poznan (the region's capital) is the most vibrant area, the northern and southern poles of the region have not been able to exploit their geographic advantages to the same extent as the central areas.

The region faces three key challenges:

- **Embedding foreign direct investments in the innovation system:** Wielkopolska is home to a large number of international companies. Efforts are needed to integrate them into the regional innovation system. The difficulty of improving co-operation between regional public research institutions and foreign companies threatens the sustainable development of the region.

- **Supporting the development and emergence of innovative companies:** in 2005, it was estimated that only one-third of companies conducted innovative activities, and during the period 2003-2005, innovation expenditure fell by almost 40%. To address inter-regional differences, support should be tailored to the potential of specific sub-regions. Support for high-tech companies makes sense in Poznan, for example, but incremental innovations appear to be more relevant in the remaining areas.

### Box 2.4. **Strategies for catching up: avoiding a supply-side bias** *(cont'd)*

- **Establishing a modern educational and training system:** Wielkopolska lacks an efficient educational and training system. This will make it difficult to tackle the persistently high level of unemployment in some areas. Increasing investment in R&D requires more specialised human resources, and the supply of science and engineering graduates is clearly insufficient at present to meet the future needs of the region.

Evaluation of regional polices conducted with the support of EU Structural Funds indicates a number of weaknesses of policy responses to these challenges. Measures to improve SME competitiveness through investments had limited impact on industrial restructuring, because the support was focused mainly on technology upgrading and did not target firm RTDI (research, technological development and innovation) potential. Measures to increase the delivery of training faced bottlenecks due to a lack of up-to-date vocational training programmes.

*Source*: Walendowski, J. (2007), "Monitoring and Analysis of Policies and Public Financing Instruments Conducive to Higher Levels of R&D Investments: The 'Policy Mix' Project: The Case of Wielkopolska", report for DG Research, *www.policymix.eu.*

### *Strategic choices for different types of regions*

The broad strategic choices for development differ according to the region's potential and limits. However, the evidence shows there are often strong mismatches between regional potential and strategic policy choices. A frequent problem is the bias towards strategies targeting top-level technological knowledge creation in areas that are most in need of accessing knowledge and developing innovation capacities.

Table 2.2 illustrates how the priority for a region within the three broad strategic choices differs according to region type (see categorisation in Chapter 1). For example, the goal of supporting economic transformation is important in all region types, but is perhaps most critical in regions categorised as Industrial production zones. Well-established industrialised regions are most in need of finding new economic specialisations and niches to remain competitive. Building on science and technology-based advantages is, on the other hand, central for a set of regions of the knowledge hub category, as well as for the most knowledge-intensive regions within the industrial production zone category. It is relevant to capitalise on those small niches and support their growth, but this is not sufficient in the short or medium term to ensure broad-based regional development. Lastly, the catching up strategy is particularly relevant for those lagging regions that do not base their development on knowledge endowments (i.e. regions that are primary-sector-intensive or experiencing de-industrialisation or structural inertia). Catching up through investments in knowledge absorption capacities can also be relevant for those regions in the industrial production zones that have relatively few knowledge-based activities and are specialised in traditional manufacturing activities.

Table 2.2. **Innovation strategies for different types of regions**

| Type of region | Main strategy: Building on current advantages (science push/ technology-led or a mix) | Main strategy: Supporting socio-economic transformation | Main strategy: Catching up: towards the creation of knowledge-based capabilities |
|---|---|---|---|
| **Knowledge hubs** | | | |
| Knowledge and technology hubs | ● | ⦿ | ○ |
| Knowledge-intensive city/capital districts | ● | ⦿ | ○ |
| **Industrial production zones** | | | |
| US states with average S&T performance | ● | ⦿ | ○ |
| Service and natural resource regions in knowledge-intensive countries | ⦿ | ⦿ | ● |
| Medium-tech manufacturing and service providers | ⦿ | ● | ○ |
| Traditional manufacturing regions | ○ | ⦿ | ● |
| **Non-S&T-driven regions** | | | |
| Structural inertia or de-industrialising regions | ⦿ | ● | ⦿ |
| Primary-sector-intensive regions | ○ | ⦿ | ● |

Notes: ● main priority; ⦿ strategic choice; ○ low priority.

These categorisations provide broad options for supporting knowledge-based regional development, but oversimplify complex regional trajectories. Such categorisations often emphasise R&D-based innovation, when factors determining innovation are much broader. In addition, dimensions beyond innovation capacity determine strategic development choices. History and political orientation matter, and inertia in political choices often constrains the spectrum of options. The degree of foreign ownership in an economy is also a crucial factor. When the share of foreign-owned firms is high and this investment consists mostly of greenfield investments, the room for manoeuvre for regional policy will depend on the degree of autonomy of regional subsidiaries and how well-established they are in the regional fabric. The mismatch between administrative and functional regions is another factor for strategic approaches. The small geographic scale of Swiss cantons is one explanation for their relatively weak involvement in innovation promotion, despite their strong institutional powers (OECD, 2011b). The intensity and quality of connectivity of regional innovation actors to international knowledge networks (of which co-invention networks are only one small part) is another important regional characteristic that influences the scope and content of innovation networks in which regional actors are involved. For these reasons, it is not possible to assign precise strategies for each type of region, but only to indicate the relevance of broad orientations.

How could these broad strategic choices be translated into practice? Tables 2.3, 2.4 and 2.5 describe examples of possible strategies by degree of regional STI competence and the associated policy mixes for each of the three broad strategic options. The policy mix reported in the tables only includes policy instruments under regional responsibility. However, national policy instruments are also at play, and combine with regional instruments to form the overall policy mix available to regional actors. Therefore, the role of national instruments increases in importance the lower the level of a region's institutional STI competences. It is important to emphasise that, for each combination of regional type and degree of regional STI competence, Tables 2.3, 2.4 and 2.5 only give examples of possible strategies and policy mixes. No unique policy model exists as many other elements influence the strategies and mix of instruments that can be adopted.

Table 2.3. **Building on current advantages: examples of regional strategies and associated policy mixes**

| Type of OECD region by economic profile | Degree of regional STI policy competences | | |
|---|---|---|---|
| | High | Medium | Low |
| **Knowledge and technology hubs**<br>Leading science and technology regions | **Strategy: reinforcing excellence in knowledge creation and developing new high-tech industries** | | |
| | Co-funding of universities: institutional and competitive<br>Funding research and technology centres<br>Public-private partnerships for innovation<br>Targeted research funds, for private and public actors, and for co-operative projects<br>Participation in national and international competitive research programmes<br>Research spin-off promotion schemes (e.g. regional seed and venture capital funds)<br>Regional high-tech clusters, S&T parks, incubators<br>Global talent attraction in targeted new sectors<br>Strategic intelligence exercises (regional foresight) | Complementing national investments in research infrastructure<br>Participation in national competitiveness pole/centre programmes (co-funding)<br>Public-private partnerships to develop high-tech products<br>S&T parks, incubators<br>Entrepreneurship stimulation packages<br>Global talent attraction in targeted new sectors<br>Promotion of participation of public and private actors in international technology networks | Lobbying national government for public investments in large S&T infrastructure linked to regional advantages<br>Participation in national competitiveness pole/ centre programmes (limited regional funding)<br>Attracting FDI of knowledge-intensive companies and MNCs (infrastructure, labour force)<br>S&T parks and incubators<br>Promoting national talent attraction schemes<br>Knowledge vouchers<br>Platforms to define development visions for high-tech niches |

Table 2.4. **Supporting socio-economic transformation: examples of regional strategies and associated policy mixes**

| Type of OECD region by economic profile | Degree of regional STI policy competences | | |
|---|---|---|---|
| | High | Medium | Low |
| **Medium-tech manufacturing and service providers** | **Strategy: modernising productive activities towards value-added niches: "innovation ecosystem strategy"** | | |
| Industrial production regions with relatively high knowledge absorptive capacities | Supporting science-industry linkages (personnel exchange and placement schemes; technology advisory services; technology diffusion)<br>Regional agencies for innovation promotion, combining technology transfer with other services<br>Promoting innovation start-ups (business angel networks, mentoring schemes, regional seed and venture capital funds)<br>Densification and internationalisation of regional production clusters<br>Regional public procurement oriented towards innovation | Technology platforms (linking technical schools and SMEs)<br>Technology transfer centres in relevant sectors, co-funded by national government<br>Regional advisory network; networks fostering synergies and complementarity between national agencies in the region and regional agencies<br>Innovation vouchers for SMEs<br>Support for young graduate recruitment in firms | Concentration of regional action on non-traded sectors<br>Supporting innovation in service or cultural industries<br>Small-scale cluster support with an orientation towards connection to global networks<br>Innovation vouchers, targeting "innovation beginners" |
| **Structural inertia or de-industrialising regions** | **Strategy: stimulating knowledge absorption and entrepreneurial dynamism** | | |
| Non-S&T-driven regions with persistent development traps | Local knowledge centres, branches of national knowledge hubs (focus on diffusion)<br>Education and training activities in firms<br>Supporting connection to international production networks<br>Regional fora to identify growth prospects in niches with value-added<br>Innovation and entrepreneurship culture promotion | Supply-chain management initiatives to reduce fragmentation<br>Innovation-oriented public procurement<br>Redefinition of programmes for regional technical schools<br>Innovation awareness raising, entrepreneurship promotion events | Developing latent demand for innovation (innovation vouchers, placement of students in SMEs)<br>Orienting polytechnics to new qualifications<br>Training for low skilled and unemployed<br>Support to clusters with innovation potential<br>Supporting inclusion of region in international production networks |

Table 2.5. **Catching up: examples of regional strategies and associated policy mixes**

| Type of OECD region by economic profile | Degree of regional STI policy competences | |
|---|---|---|
| | High | Medium and Low |
| **Primary-sector-intensive regions**<br>Generally rural areas in lesser developed OECD countries, specialised in primary sector activities | **Strategy: upgrading and retaining human capital, creating critical mass and increasing quality of connectivity** | |
| | Regional agencies for business development<br>Training and lifelong learning courses (public offer, incentives for firms)<br>Student exchange programmes and talent attraction schemes<br>Regional incentives for skills upgrading programmes in companies<br>Incentives for hiring qualified personnel in companies<br>Creation of knowledge centres in traditional fields (agriculture, tourism…), branches of national research organisations<br>Innovation support programmes for incremental innovations (innovation intermediary, business development support)<br>Linkages of business support organisations (chambers of commerce, etc.) to wider networks<br>Financing experimental innovative projects in traditional sectors<br>Connection of regional actors in national and international production networks | Innovation support programmes (innovation intermediary), business development support (branch of national agencies), connection with trade and export agencies<br>Attracting national investments in vocational and tertiary education<br>Promoting national training, lifelong learning schemes for companies and individuals<br>Engaging regional stakeholders in external production networks<br>Securing national infrastructure investments to enhance connectivity |

## 2.3. Implementing smart policy mixes

Once the broad direction of innovation strategy is clear from the regional point of view, the next concern is the content of the policy. How can the region mobilise key actors, using governance instruments and resources, to achieve the policy outcomes identified in the regional vision? Which policy instruments should be used? Policies are affected by two countervailing forces. On the one hand, it is easy to get bogged down in policy inertia and revert to traditional patterns even when priorities change. On the other hand, it is possible to get caught up in enthusiasm for the latest policy tools, irrespective of the needs of the region in question. Furthermore, policy makers are subject to requests from lobby groups. These regional constituencies can be useful as a source of information from the beneficiaries of policies, but they are difficult to incorporate in the policy mix, since they express particular interests and not necessarily the public interest. The challenge is to ensure that the policy mix – i.e. the combination of policy instruments available in a given regional environment from all levels of government – is effective in reaching the policy goals. This effectiveness concerns that of each policy instrument individually, as well as the synergy across the instruments from various policy fields and origins.

### *A taxonomy of policy instruments for regional innovation*

It can be helpful to evaluate policy instruments, in terms of certain general characteristics. One such dimension is their objective (knowledge generation, diffusion and exploitation). A second dimension is the level of political acceptability of the intervention (traditional, emerging and experimental instruments). Table 2.6 describes the regional innovation portfolio in this two-dimensional matrix, focusing on objectives and degree of policy acceptability (see Chapter 6 for more details on individual policy instruments). The table encompasses instruments that are generally seen as at the core of innovation policy. However, actions and programmes in other areas, in particular education policy, also play an important role in ensuring adequate conditions for innovative activities.

Policy instruments may target knowledge generation, diffusion or exploitation, or several of those objectives simultaneously. Knowledge generation includes the specific incentives and regulations for the production of scientific and technological knowledge, including mechanisms to attract talent, and specific incentives for supporting R&D activities in firms. In general, regional action tends to focus on instruments supporting knowledge diffusion, taking agglomeration effects and proximity into consideration. These first two categories include mostly linear and supply-side instruments. Many regions are also active in knowledge exploitation, which includes measures directed towards the demand side of innovation, in support of the application of existing knowledge in production. Technological extension services, business development support and human capital development are some of the traditional mechanisms used to encourage innovative business practices.

The new generation of innovation policy instruments tends to have a more systemic approach. This new approach seeks to minimise boundaries between generation, diffusion and exploitation by offering a mix of support for all three phases. For example, the new generation of science and technology parks, in addition to their emphasis on knowledge diffusion between different agents, tends to offer complex services intended to encourage both knowledge generation and exploitation (see full discussion of this instrument in Chapter 6). The impact of a more systemic approach to the role, missions and profile of regional innovation agencies established in many OECD regions is another sign of this new approach (see Chapter 5).

In terms of political acceptability, it is possible to distinguish between traditional, emerging and experimental instruments. Traditional instruments are those commonly considered as levers to support innovation. Emerging instruments include new forms of support to innovation recently introduced by regions, and which respond to a willingness to try new types of policy support (e.g. voucher schemes, user-driven innovation programmes, etc.). Experimental instruments are measures that are supported by certain governments, but whose rationale and implementability are not universally accepted. Examples include public procurement and other industrial policy types of support for innovation, as well as cross-border instruments whose effects extend beyond regional borders. It can be more difficult to argue for the inclusion of experimental or emerging instruments in the policy mix, albeit proving effectiveness is valid for all forms, including traditional instruments.

Table 2.6. **Regional innovation policy instruments: a taxonomy**

<table>
<tr><th></th><th>Knowledge generation</th><th>Knowledge diffusion</th><th>Knowledge exploitation</th></tr>
<tr><td>Traditional instruments</td><td>Technology funds, R&D incentives/supports/grants<br>Support for scientific research and technology centres<br>Support for infrastructure development<br>Human capital for S&T</td><td>Science parks<br>Technology transfer offices and programmes<br>Technology brokers<br>Mobility schemes, talent attraction schemes<br>Innovation awards</td><td>Incubators<br>Start-up support<br>Innovation services (business support and coaching)<br>Training and raising awareness for innovation</td></tr>
<tr><td rowspan="2">Emerging instruments</td><td>Public-private partnerships for innovation<br>Research networks/poles</td><td>Innovation vouchers<br>Certifications/accreditations</td><td>Industrial PhDs<br>Support for creativity and design<br>Innovation benchmarking</td></tr>
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<tr><td>Experimental instruments</td><td>Cross-border research centres</td><td>Open source-open science markets for knowledge</td><td>Regional industrial policy<br>Innovation-oriented public procurement</td></tr>
</table>

*Source:* Nauwelaers, C. and A. Primi (forthcoming), *Innovation Policy and Regions: Policy Spaces, Strategies and Challenges*, Regional Development Working Papers, OECD Publishing, Paris.

## *Traditional and emerging instruments*

Traditional instruments supporting innovation in regions generally reflect a linear view of innovation. They tend to differentiate between, and offer separate support for, knowledge generation, diffusion and exploitation. However, more complex instruments simultaneously covering the different functions are emerging (Asheim *et al.*, 2003). Interestingly, policy instruments with the same designation can fall into various categories depending on their specific implementation features.

Science and technology parks have been extensively used to support innovation for commercial purposes, building strong connections with regional administrations. They make knowledge generation and diffusion possible, support the creation of innovation-based companies, and encourage R&D and innovation. S&T parks offer infrastructure, value-added innovation services and direct incentives to innovation investments. Their implementation and effectiveness is influenced by: the participation of committed champions in the park; strong management leadership; appropriately designed and sustainable funding; the existence of bridging institutions; the continuity of flow of human resources, networks and capacities; and the formulation of effective metrics to make achievements visible (Wessner, 2009).

Another policy instrument that can now be considered traditional, given its widespread adoption, is support to clusters (OECD, 2007a). Such policies focus on the networks and relationships between companies and other innovation actors. It relates both to horizontal collaboration and vertical integration in production and emphasises the advantages of proximity, trust and repeated business transactions to enhance productivity growth. In general, the instruments for cluster development include support to large-scale collaborative programmes; services to improve individual, and hence collective, competitiveness; and activities that encourage a culture of innovation.

Emerging instruments include a new generation of S&T parks and clusters that combine support for knowledge generation, diffusion and exploitation. These tend to match incentives for R&D and scientific activities to downstream business applications, and investment in cultivating research skills, as well as management support. Korea's new parks, for example, tend to offer extensive services for firms and research organisations. They are usually set up and managed by the national government, but regional administrations are increasingly playing a role in their management. Another new trend is the creation of "open clusters", featuring proximity in competences as well as geographical proximity.

An analysis of research and technology centres can help to illustrate the difference between the three categories of traditional, emerging, and experimental instruments. One typical instrument for encouraging knowledge generation in regions has been the establishment of research centres, often with a view towards a balanced distribution in the national territory. In Korea, regional research centres emphasise collaboration between regional universities and regional industries and support sharing of experimental facilities between the university and regional SMEs (OECD, 2009a). Other countries follow a top-down approach, with public research centres created by national authorities in different regions/states in the country, such as for example the CRITT (Centres for Research and Technology Transfer) in France. The result of these experiences is mixed. In Chile and Mexico, this strategy mostly led to under-financed research centres that lack critical mass for carrying out top-level research and generated few linkages between regional entrepreneurial activities and the research centre.

Recently, technology centres have taken the form of public-private partnership institutes. The goal is not only new technology development, but exploitation in the business sector, emphasising the co-creation of new knowledge between public and private actors. The recent tendency is to recognise the need of agglomeration and concentration for research and to support cross-border research centres that relate to functional areas, rather than to administrative boundaries. Supporting cross-border innovation is not universally accepted. While the relevance of this dimension is acknowledged in principle, it remains difficult to design and implement appropriate incentives and accountability mechanisms for the various regions involved.

Regional governments have always played a substantial role in supporting knowledge diffusion by fostering talent attraction, retention and mobility. In Spain, several regions have developed talent attraction agencies to recruit international researchers to their region's universities and research centres. This mechanism has helped to overcome regulatory problems in Spain for recruiting academic talent in public institutions. Catalonia's iCrea, now part of the Talència agency, has recruited over 210 researchers and research professors. This influx of talent has made measurable contributions to the region's innovation system in terms of attracting EU and Spanish competitive research grants, as well as scientific publications, among other benefits (OECD, 2010a). The Basque Country developed a similar initiative, Ikerbasque. Biscay province in the Basque Country has a programme to support talent attraction to firms, including relocation services for newcomers. Policy action acts both on a horizontal basis (i.e. without a preference for specific scientific areas) and on a targeted basis, favouring the match between industrial demand and skill supply (OECD, 2011b). In China, incentives to recruit foreign IT personnel are managed at the provincial level. Beijing offers special conditions for repatriation, such as permanent residency for the expat and his family, facilities for children's schooling, subsidies for housing, and other facilities. Incentives for talent mobility within regions, typically between the science sector and industry, are also an area of action for regional governments. In Belgium, Wallonia has developed and expanded its FIRST programme, promoting inter-sector mobility.

Other traditional instruments in support of knowledge exploitation with a strong territorial vocation are innovation incubators. Modern innovation incubators offer not only infrastructure and seed capital for innovation, but also business development and "soft" support.

Emerging instruments include integrated incentives for knowledge generation, diffusion and exploitation, and new schemes targeting each of the phases separately. For example, as mentioned above, regional governments increasingly support public-private partnerships for R&D. Regional administrations often have authority over the design and implementation of certification and accreditation schemes that influence the diffusion of innovation in certain sectors. Such interventions are particularly relevant because they act as a demand generator for a given innovation in the region. An example is the use of certifications by the Trento region in Italy, which facilitated the transition towards a sustainable and green regional socio-economic system.

Emerging instruments within the innovation policy portfolio also include training or other initiatives aiming at developing creativity skills. This can take place within the tertiary education system, or take the form of life-long learning programmes. Several regions implement integrated programmes within the design sector and promote their regions as hubs for design-driven innovation.

The innovation voucher instrument is one example of a successful policy experiment at the regional level. The voucher allows firms to choose their innovation service provider, even on a cross-border level. The Netherlands was a pioneer in the development of this new instrument, which has been picked up in other countries. In the Dutch case, the instrument was initially developed at the regional level (province) and subsequently adopted at the national and international levels (the Netherlands and Belgium), indicating how regions can act as policy laboratories for innovation policy.

A scarcity of risk capital is a notorious barrier to innovation, especially for smaller and highly innovative firms. The rationale for public intervention in risk capital is that the market is not always a reliable source of financing for innovation, due to uncertainty and information asymmetries. Venture capital funds require a wide pool of good projects for selection, and minimum deal size. When managed at the regional level, such funds tend to behave like private venture capital; hence it is preferable that regions concentrate on seed capital supply to new technology firms, where the chance of market failure is highest. Seed capital funds need regional roots to help identify good opportunities. Regional authorities can often be helpful in establishing regional networks of "angel" investors, i.e. private investors in new ventures. These investors not only provide risk capital, but advice and access to professional and business networks (Bonaccorsi, 2010).

Regional governments can play a key role in offering collective and business-targeted innovation services to support production development and innovation. This is the case in regions offering strong public support in infrastructure, such as Emilia Romagna in Italy, as well as in more hybrid development models, for example in China. The types of services offered include information sharing, targeted advice to business development, managerial support, support for networking, matching technology supply and demand, etc. Innovation benchmarking is another emerging policy instrument that favours innovation awareness and exploitation in selected firms. Often, these business innovation support functions are delivered or managed by regional development or innovation agencies (see Chapter 5).

### *Experimental instruments*

Experimental instruments include several whose design and implementation is complex and not generally accepted. Cross-border research centres and support to knowledge diffusion on the basis of the open science paradigm are still controversial for their cross-country and cross-regional impact. In addition, industrial policy support and public procurement deserve special attention in the design of regional green growth strategies. Public procurement (the acquisition of goods and services by government and/or public sector organisations) is a powerful tool for affecting innovation dynamics. Its use is controversial, but worth taking into account. On the one hand, it can be an *ex ante* guarantee of demand for innovative products. It can be used to shape the direction of innovation and technical change by establishing criteria for privileging certain types of innovations/solutions over others (for example, on the basis of their environmental impact). It favours the dissemination of given technologies and/or solutions in domestic economies. Public procurement has been extensively used as an industrial development tool, and it has recently regained the attention of policy makers interested in environmental sustainability. Public procurement is seen as a key tool for creating markets for sustainable and eco-friendly technologies and solutions that would otherwise not find their way to the market, either in terms of incentives to search for alternative solutions, or in terms of existing markets for application and diffusion.

## ***Searching for synergies and balance within mixes of policy instruments***

Support for R&D and technology development may not only involve traditional instruments from the STI sphere, but also a series of other interventions. They may include: support to human capital development, training, regulations and certifications, financing schemes beyond R&D subsidies, innovation-oriented public procurement, and a series of policy actions that extend beyond innovation policy. In addition to striking the regionally adapted balance between knowledge generation, diffusion and exploitation, the choice of instruments is also shaped by the institutional capacities, the prevailing specialisation pattern of the region and by the vision of the agency or ministry leading the policy process.

The policy mix of instruments should correspond with the objectives of the strategy. This means that: *i*) the balance between various types of instruments should be adapted; and *ii*) positive interactions and synergies between policy instruments need to be revealed and maximised, while negative interactions are to be avoided. A successful innovation policy mix is not solely determined by the quality of the design and implementation of each component individually, but also the synergies achieved between the different components. Recent research within the European Union on policy mixes to promote R&D has shown that those interactions are generally poorly taken into account in policy design because the implementation of instruments tends to be fragmented (Nauwelaers *et al*., 2008). However, the effect of any policy instrument, whatever the quality of its intrinsic design, is dependent on complementary conditions and resources.

There are several key issues for building smart and efficient policy mixes. They include:

- the value of integrated ("packaged") policy instruments;
- the need to find the right balance between instruments addressing firms in isolation and systemic relations, and fostering internal and external connections;
- the importance of drawing effectively on the effects of other areas of policy and acknowledging the role of universities in regional innovation;
- the vital role of human resources for innovation and associated policies to attract and retain talent within policy mixes; and
- the need to put more weight on demand-side policy instruments, in particular by introducing innovation-oriented public procurement.

### *Packaged instruments for innovation*

Policy is becoming more systemic, by identifying interventions on the knowledge generation, diffusion and exploitation sides, and trying to improve the interaction among them. One option is to incorporate the interactions within one policy instrument instead of several individual instruments. Contemporary innovation policy instruments tend to move towards more holistic support, integrating support to knowledge generation, diffusion and exploitation into single packages. Those packages target a variety of regional actors jointly, rather than separately, and hence incorporate the systemic aspects of innovation. Meanwhile, traditional instruments targeting the different functions and individual actors persist, and for these, the question of articulation with other instruments can be problematic. The concept of "mini-mixes" has been coined within the "policy mix" project cited above, to describe packages of instruments that aim to promote synergies across policy instruments. The example of the Dutch Innovation Programmes illustrates one such way of designing instruments (see Box 2.5).

### *Identifying the right balance within a policy mix: firms and systems, the local and the global*

To find a good balance of instruments within a policy mix, it is necessary to start with a complete view of the whole set of instruments targeting specific objectives. SMEs are a frequent target group for innovation policies with a regional dimension, but the policy instruments to support innovation in this target group are often numerous and rarely articulated in a coherent package. These policy instruments can be distinguished, on the one hand, between policies targeting companies as isolated actors or as parts of a regional system and, on the other hand, between instruments providing resources (financial, human capital) or addressing the need for new learning capacities (Asheim *et al.,* 2003). This balance is also relevant for other areas of support beyond SMEs.

#### Box 2.5. **"Mini-mixes": integrated policy packages**

"Mini-mixes" combine several types of R&D policy instruments usually designed as single instruments, assuming that positive synergies will emerge from a packaged approach and negative trade-offs can be avoided. They combine R&D and non-R&D instruments to approach an issue comprehensively. The design and implementation of the mini-mix are shared across different governance boundaries (e.g. ministries or domain-related agencies) and between levels of government in some cases. User-oriented programming and systemic analysis are used to tackle issues in a coherent manner.

The Netherlands' Innovation Programmes in the Key Areas is one such example. Its integrated approach results in user-driven, public-private innovation programmes to create focus and critical mass. In 2006, in response to the Key Areas approach, the Dutch Ministry of Economic Affairs introduced a new policy instrument called the "programmatic approach". Three features of this approach are relatively new in Dutch innovation policy:

- The programmatic approach focuses either on specific themes, or a technology domain or societal issue, with a goal of international excellence.
- The process of selecting these national priority research themes involves making use of technological foresight exercises, high-level panels, and bottom-up competition for themes, proposed by companies and other stakeholders acting jointly.
- The approach relies on a bottom-up process in which a consortium of stakeholders (public-private partnerships) and particularly the business sector, take the initiative to define the main portfolio or mix of instruments and the content of the programme. Linkages are stimulated, both between academia and industry and between companies. Another trend is increased involvement of public research institutes as stakeholders in the design of a given programme.

The Point-One Programme (P1) was the first Dutch Innovation Programme to become operational, established by four leading large companies and two research centres. These key partners defined the Strategic Research Agenda and the main bottlenecks in the innovation system where public-private partnerships can make a difference. P1 works along four strands:

- **Strand 1: Strategic research initiatives**: strategic collaborative research projects on nanoelectronics and embedded systems are intended as a Dutch contribution to the European Research Agendas ENIAC (nanoelectronics) and ARTEMIS (embedded systems). The Dutch contributions to the large international research consortia are an active link from P1 to European R&D. This includes large strategic projects, as well as two Open Calls for SMEs.

### Box 2.5. "Mini-mixes": integrated policy packages *(cont'd)*

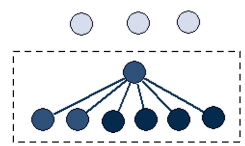
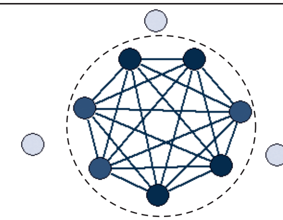
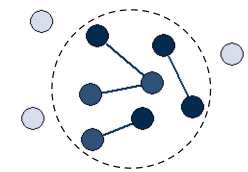
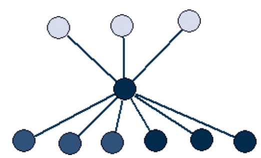
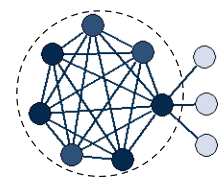
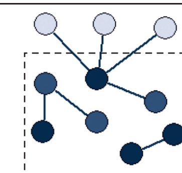
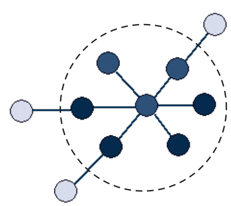
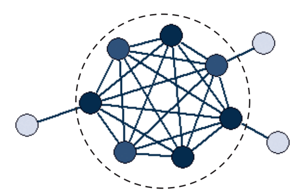
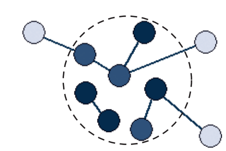
- **Strand 2: Open Innovation Institutes**: P1 aims to be closely associated with the business plans of the Embedded Systems Institute (ESI) and the Holst Centre, creating an open interface within industry and between industry and academia and aligning industrial needs with academic technology input.
- **Strand 3: Interaction between academia and industry**: the aim is to align academic and polytechnic curricula with industry and meet industrial needs for skilled workers and training. Examples of planned activities include the development of a Human Capital Roadmap; bringing together industrial demand and academic supply; support of part-time professors and experts from *pôles de compétitivité* industries to engage in teaching and research in academia; and encouraging students to study nanoelectronics and embedded systems.
- **Strand 4: SME development**: P1 aims to actively support existing SMEs and start-ups and to improve SME global competitive positioning in relevant technologies. Activities foreseen are: an SME radar screen and capabilities definition; an SME quality improvement programme; facility sharing; a venture capital fund; extension of the existing voucher system specific to nanoelectronics and embedded systems; and an open call for R&D projects targeted to SMEs.

*Sources*: Boekholt, P., E. Arnold and M. de Heide (2007), "The Use and Effectiveness of Programmatic Policies; Some Examples and Evidence from Around the World", Technopolis Group, Amsterdam; Boekholt, P. (2007), "Thematic Report: Mini-Mixes", report for DG Research, *www.policymix.eu*; Wintjes, R. (2007), "Monitoring and Analysis of Policies and Public Financing Instruments Conducive to Higher Levels of R&D Investments: The 'Policy Mix' Project: The Case of Netherlands", report for DG Research, *www.policymix.eu*, Point-One website: *www.point-one.nl*.

An additional element to consider is the quality of regional and global linkages of the regional innovation system. Several cases can be distinguished by the density of regional linkages (centralised, decentralised dense or decentralised sparse RIS) and the extent of connections to the global networks (no hinges, single hinge or multiple hinges) (Table 2.7). Policies to address these different combinations of connectivity would need to be fine-tuned to the internal or external connectivity patterns (Table 2.8). Strengthening external connections would need to be a priority for systems that are peripheral and not well connected to the outside networks, while tools to densify regional linkages would be critical for those fragmented regional systems missing opportunities given by strengthened regional networks.

A smart policy mix for innovation at the regional level would need to include several instruments to support the region's role as an agent of change. These instruments would need to target individual firms, foster regional linkages and flows within the region, expand regional actors' connections to external networks and put resources in the system (Table 2.9). The balance between those elements has to be defined according to the state of development of these different aspects, e.g. focusing on creating external hinges when the regional innovation system suffers from endogamy or strengthening SME internal capacities when this proves to be a bottleneck. It will often be necessary to carry out consultations or firm surveys to get an accurate picture of those bottlenecks.

Table 2.7. **RIS: typology of external and internal linkages**

| | Centralised RIS | Decentralised Dense RIS | Decentralised Sparse RIS |
|---|---|---|---|
| **No Hinges** |  |  |  |
| **Single Hinge** |  |  |  |
| **Diverse Hinges** |  |  |  |

*Source*: Benneworth, P. and A. Dassen (forthcoming), *Strengthening Global-Regional Connectivity in Regional Innovation Strategies*, Regional Development Working Papers, OECD Publishing, Paris.

Table 2.8. **Policy objectives according to RIS configurations**

| | No hinges | Single hinge | Diverse hinges |
|---|---|---|---|
| Centralised RIS | Build hinge through hub | Build global connections | Regional networking |
| Decentralised dense RIS | Find external connection/get a global perspective | Build global connections | Anchor global firms regionally |
| Decentralised sparse RIS | Change system/ path-breaking grand project | Increase regional networking/build global connections | Increase regional networking/ prepare for global linkages |

*Source:* Benneworth, P. and A. Dassen (forthcoming), *Strengthening Global-Regional Connectivity in Regional Innovation Strategies*, Regional Development Working Papers, OECD Publishing, Paris.

Table 2.9. **Innovation policy instruments targeting SMEs**

| Target of support | Form and focus of innovation support services for SMEs | |
|---|---|---|
| | Reactive tools providing inputs for innovation | Pro-active tools focusing on learning to innovate |
| Global connections | Excellence poles<br>Cross-border technology centres<br>Funding for international R&D or innovation projects | International technology transfer schemes<br>Mobility schemes<br>Support for global networking of firms<br>Cross-border innovation vouchers<br>Lead market initiatives |
| Regional system | Collective technology or innovation centres | Cluster policies<br>Pro-active brokers, matchmakers<br>Innovation vouchers<br>Support for regional networking of firms<br>Schemes acting on the culture of innovation |
| Individual firms | Incubators with “hard” support<br>Traditional “reactive” technology centres<br>Seed and venture capital funds<br>R&D subsidies or tax incentives | Management advice<br>Incubators with “soft” support<br>Pro-active technology centres<br>Audits, monitoring of needs<br>Innovation coach<br>Innovation management training<br>Techno-economic intelligence schemes |

*Source*: Nauwelaers, C. and A. Primi (forthcoming), *Innovation Policy and Regions: Policy Spaces, Strategies and Challenges*, Regional Development Working Papers, OECD Publishing, Paris, expanding from Asheim, B., A. Isaksen, C. Nauwelaers and F. Tötdling (2003), *Regional Innovation Policy for Small-Medium Enterprises*, Edward Elgar, Cheltenham, United Kingdom and Lyme, United States; Technopolis (2011), “Review of Innovation Promotion Instruments at Regional Level”, background report for the OECD.

The balance among instruments targeting SMEs is another important element in building smart policy mixes. High-tech companies or academic spin-offs need different types of support from companies that are still at the periphery in terms of knowledge generation. The public offer should provide support not only to R&D but also to the different elements of an innovation strategy, including business development and managerial capacities and other innovation-related services. Effective policy mixes targeting innovation should therefore combine instruments from various policy fields:

- **Regional development policy.** The target has traditionally been lesser developed regions, with a special focus on SMEs and the engagement of regional actors.

- **Science and technology policy.** The focus is usually on high-technology creation and diffusion, the promotion of R&D instruments in support of commercialisation, the reinforcement of science-industry linkages, and achieving commercial impacts of R&D investments.
- **Industrial and enterprise policy, notably SME policy.** The approach is on supporting the needs of groups of firms and technology absorption, particularly in SMEs, and increasing competitive advantages in order to attract investment and promote knowledge spillovers.
- **Higher education policy.** This is a key policy domain for ensuring an adequate supply of skilled workers in the regions and the availability of new knowledge.

### *The special role of higher education institutions in regional innovation*

Since human capital is the main driver for innovation in regions, policies for upgrading the skills and competences of the labour force deserve special attention. Higher education policy is particularly relevant for innovation policy from a policy mix perspective. Higher education institutions (HEI) are increasingly called on to take part in regional development. Numerous OECD reviews on higher education and regions have concluded that the regional engagement of HEIs is on the rise. First, HEIs act as knowledge creators through research. Second, they contribute to knowledge transfer through education and other educational activities, notably lifelong learning. Third, they influence cultural and community development, notably by supporting new firm creation and nurturing entrepreneurship, and engaging in joint R&D and innovation projects. Often this regional engagement is initially the product of bottom-up initiatives rather than the result of policies. National policies and incentive structures for HEIs are generally neutral with respect to geographic location and do not promote such regional engagement in most cases. Nevertheless, a growing set of funding schemes and incentives are being established at national and regional levels to promote the "third mission" of HEIs. This mission includes: the engagement of HEIs in cluster-type structures or in joint public-private partnerships on R&D; development of intermediary structures to facilitate access of companies to HEI resources; joint development of training and education curricula between regional companies and regional HEIs; and entrepreneurship programmes (OECD, 2007c).

The role that HEIs, and in particular universities, can play in regional development and innovation is diverse. Universities may follow a differentiated profile, as in Australia, the Netherlands, Switzerland, the United Kingdom or the United States. Universities may on the contrary take a non-differentiated form (institutionally and vertically), as in most European countries. In a differentiated system, one can identify at least three models operating at different geographical scales:

- Top-level universities have an international horizon, attracting students and recruiting academic staff worldwide. Their contribution to regional growth is supply-push rather than demand-pull.
- Generalist universities with a national scope are in a mixed position. They are usually large, multi-disciplinary, sometimes very old and respected. In principle, they may agree to collaborate with the regional system, but this may prove difficult in practice.

- Regional universities (which may follow a variety of organisational models) have the mission of offering qualified training and of carrying out applied research, usually with some correspondence with the needs of regional industry (Laredo, 2007).

Table 2.10 summarises a menu of policy approaches for each of the three types of universities. There are different spaces for regional action, according to the nature and scope of the knowledge activity in question. Regional innovation policy might: *i*) be more or less pro-active; *ii*) define policy goals differently; *iii*) focus more on education, star research, applied research, or third mission (service to society); and *iv*) use a menu of policy tools, including investment in infrastructure, research funding, research co-funding, and institutional funding.

Table 2.10. **Universities in the regional innovation system**

| Type of university | Production conditions | Co-ordination conditions | Implications for regional innovation policy |
|---|---|---|---|
| World-class | Global recruitment of academic staff<br>Large share of foreign students. International PhD programmes<br>Industrial collaboration with multi-national corporations on a global basis | Shaping the overall strategy and policy of universities is difficult | Top universities bring wealth to the region by attracting students, staff and industrial collaboration<br>The main goal of regional policy is to maintain a high quality of life and environment (e.g. student facilities, accommodation, services) |
| Mid-range and generalist | National academic staff<br>Industrial collaboration mixed (national/regional) | Most difficult to co-ordinate: universities need regional funds but want to maintain their autonomy. They consider the regional dimension as a limitation<br>However, they have limited attractiveness outside national boundaries | Need for a clear regional research strategy that identifies areas of common interest without being trapped in funding the overall university budget |
| Regional model | Applied research focused on regional industry needs<br>Training students in professional and technical areas related to regional interests | Universities funded by regional government<br>Governance deeply influenced by region (e.g. regional representatives may serve on governing boards) | Need for maximising the impact of regional universities across a wide range of innovation activities |

*Source*: Bonaccorsi, A. (2010), "Unbundling Regional Innovation Policies", background report for the OECD.

### *Talent attraction and retention*

Securing adequate human capital for innovation must be at the heart of smart policy mixes for regional innovation (see Chapter 6). From a policy mix perspective, these instruments, to be most effective, must be combined with an improvement of other regulations related to talent mobility, notably creating an attractive environment (living conditions, taxation, etc.). Skilled people move in response to economic opportunities abroad, as well as in response to the migration policies in destination countries. Other factors play a role in the decision of the highly skilled to migrate and in their choice of destination: living conditions, opportunities for leisure, education, research or language training. In the case of researchers and academics, the conditions in the host country regarding support for research and demand for R&D staff and academics can be an important determinant in whether to migrate and where. Among the entrepreneurially minded, the climate for innovation generally, and for business start-ups and self-employment in particular, may play an important role in the decision of the highly skilled to move abroad. Thus, in addition to specific talent attraction schemes, a wide array of policies come into play:

- Public education and training policies should stimulate continued education and lifelong learning. These policies should strengthen efforts to reduce the number of people who do not complete secondary education and increase the number of postgraduate students and doctoral researchers. Measures include economic incentives to encourage inflows of students as well as support for research through scholarships, fellowships, grants, facilitated procedures, institutional arrangements (e.g. scientific visas) and service centres.
- Regulatory conditions for the labour market should also be attractive to facilitate job creation and job mobility. Labour market policies play an important role in labour market flexibility in general, and geographic mobility in particular. These policies should guarantee social protection and health care insurance. These policies are mostly managed at the national level.
- The migration of high-skilled talent, in particular the role that the infrastructure for research and innovation play in persuading top talent to migrate, introduces another dimension over which governments have influence. Migration policies need to be co-ordinated with science and innovation policies to enhance the attractiveness of receiving countries but also the countries from which talent flows (OECD, 2001).

### *Incorporating demand-side instruments*

Innovation policies have traditionally focused on the supply of technology, human and financial resources, often oriented towards R&D activities. However, there is also room for policies to stimulate the demand side of innovation, i.e. the emergence or reinforcement of new markets with high innovative potential (OECD, 2010b). Governments cannot substitute for private actors in creating commercially viable markets. Their intervention can only be indirect, and take the form of creating stimuli and adequate framework conditions for increased demand for innovation (Table 2.11). The establishment of rules, regulations and standards is a wide area with an important role for governments. Technical specifications for products, certification procedures and the introduction of regulations for the introduction of new technologies may all have a wide impact on innovation demand. The new regulations for more environmentally friendly and energy-saving products and systems in the building industry clearly illustrate this. They have created important new markets and transformed consumer preferences. The establishment of standards may hamper or facilitate innovation. Depending on the timing and orientation, they can lead to technology lock-in or, to the contrary, to new developments. Consumer policy can also help to enhance the awareness and acceptability of innovation by end users, and facilitate the interaction between customers and producers, giving producers a better perspective on current and future market potential. “Lead market” initiatives, such as the German High-Tech Strategy or the European Union Lead Market Initiative, are intended to support the creation of new markets through integrated demand-side policies. At the core of these initiatives lies the effective use of the above policy instruments (regulations, standards, public procurement). Rules and regulations have also been used to promote innovation specifically in SMEs.

Table 2.11. **Main demand-side innovation policy instruments: key features**

| Features | Public procurement | Regulations | Standards |
|---|---|---|---|
| Objective | New product or service | Market uptake, increased competition, societal goals | Market uptake, inter-operability, transparency |
| Main player | Government | Government | Industry |
| Inputs | Money, performance requirement, skills | Legal process, need to co-ordinate | Standards agencies, need to co-ordinate |
| Participation incentive | Sales, preferential treatment (e.g. SMEs) | Mandatory | Voluntary |
| Effects on success | Improved public services | Reducing market risk | Reducing market risk |
| Potential risks | Insufficient skills in public sector | Conflicting goals, length of process | Technology lock-in |

*Source:* OECD (2010), "Demand-side Innovation Policies", report DSTI/IND/STP(2010), OECD, Paris.

Simplification and transparency of procedures and aids is another characteristic of a smart innovation policy mix. Recently, a panel of European business representatives was convened to provide perspective on priorities for future European innovation policy. They concluded that "the existing support for smaller or innovative companies (grants, seed or venture capital, loan guarantees) is fragmented" which results in sub-optimal mobilisation of private sector investment (Innovation Unlimited, 2009). In the words of the UK's Minister for Business and Enterprise:

> We have the working capital scheme, the enterprise finance guarantee scheme, the capital for enterprise fund, the transition loan fund, the European Investment Bank's supported loan scheme for growing firms, the EIB-backed automotive industry loan scheme, and the GBP 1 billion non-EIB-backed automotive loan scheme. All have different rules and criteria. They have different forms and require different business data. The result is confusion for businesses, and failure to deliver in Whitehall (Hansard, 2009).

### *Guidelines for designing smart policy mixes*

The design of smart policy mixes for innovation in regions cannot be reduced to a series of simple recipes. The above discussion, however, illuminates some principles that could serve as guidelines.

**First, avoiding negative interactions among various policy instruments and fostering positive ones is the principle challenge.** As an example, the incentive system operating at universities should find a way to combine rewards for research excellence and engagement in regional innovation, rather than generate conflicting objectives. Gathering information from the beneficiaries of policies, typically through surveys, can identify unwanted or unexpected interactions. For example, the actual target groups of intermediary bodies in charge of raising awareness of innovation can be identified in order to detect a possible mismatch between their mission (addressing the SMEs with low absorptive capacities) and their actual activity (possibly targeting an upper segment of innovation-aware companies). When introducing new policy instruments, a clear understanding of the scope and impact of existing instruments can help to encourage synergies and complementarities rather than duplication or perverse effects.

**Second, finding the right balance between instruments acting on various aspects of a regional innovation system depends on a good understanding of the system.** Whether to prioritise densifying links within the regions or to open up towards outside networks is one important choice. Typically, the choice would then be to decide whether innovation support agencies or cluster policies should focus on regional actors, or connecting with actors in other regions. Another choice refers to the balance between reinforcing firm absorptive capacities and fostering new knowledge creation. Typically, the role and mission of competence centres, as well as the profile of people involved in innovation support in these centres, will differ depending on the chosen priority. Fundamental research or lifelong learning courses can both be developed by such centres, and the balance between the two types of activities needs to be decided in view of the region's main needs. Identifying bottlenecks in the regional innovation system is a starting point for defining the policy balance.

**Third, the process of refining policy mixes will be greatly facilitated if all policy instruments benefit from a clear definition of objectives and target groups, and are evaluated properly.** Generic mission definitions of innovation agencies or programmes often do not correspond to the reality. Little is often known about the actual use and effect of the innovation instruments. Another common drawback is the weak value added of some instruments (e.g. when public funding crowds out private funding). Without clarity over the action of existing policy instruments, one cannot design an effective policy mix.

**Fourth, policy mixes should focus on outcomes.** Policy instruments need to start from expected results rather than from the internal mechanisms of instruments. In doing so, it will become immediately clear that policy instruments from various policy fields interact to influence the expected results. Rules and funding mechanisms for higher education need to take into account innovation promotion goals for relevant types of universities; incentives for employment in firms need to incorporate the innovation imperative; labour market and migration policies should facilitate attraction and retention of talents, etc. The range of relevant instruments expands to cover many instruments that are categorised as "demand-side" instruments: rules and regulations, public procurement mechanisms, etc.

### *Policy learning for smart policy mixes*

Ultimately, the key to getting the right policy mix lies in the strategic capacity of policy makers. This capacity depends on the availability of appropriate information, monitoring, evaluation and analytical tools and policy commitment to innovation at the highest policy levels. Thus, there is a need to support policy learning, leave room for policy experimentation, and to encourage full policy-making cycles that integrate analysis, co-operation with stakeholders and evaluation into the design of smart innovation policy.

This chapter addressed the issue of objective, content and interdependence of various national and regional policies to encourage innovation. The next chapter analyses the vertical and horizontal governance challenges associated with successful implementation of the smart policy mix addressed in this chapter.

# *Annex 2.A1*

Table 2.A1.1. **The regional dimension in national innovation strategies: selected OECD countries**

| Country | National innovation policy and regions |
|---|---|
| Austria | Federal context: nine federal states with their own governments are developing their engagement in STI and co-finance some major federal programmes, as well as some public research institutes. Most regions host regional agencies supporting innovation. Their strategies vary according to regional diversity. Overall, regional contributions to public STI funding are increasing, but are still limited in quantitative terms. Use of EU Structural Funds (limited funding source). Main regional actions: incubators, cluster initiatives, competence centres. Limited vertical co-ordination. |
| Belgium | The regions and communities hold the main responsibility for research and innovation. The federal level has limited competences, confined to some aspects of science and research policy (not innovation), including R&D tax credits. In budgetary terms, the main actor and funder is the Flemish Community. The Walloon and French Community interventions are substantial, those from the Brussels Capital Region marginal. There is no co-ordination between the two Communities, the three regions and the federal state, due to the sensitivity of institutional issues of competences allocation between the six entities. The tendency is towards an erosion of responsibilities at the federal level, with the exception of the R&D tax incentives. Important ERDF (European Regional Development Fund) funding in the past helped establish competence centres in Wallonia, but this contribution has become a minor source. |
| Canada | Provinces have a large degree of freedom, competences and budgets to develop regional innovation initiatives, high-tech corridors, science parks, incubators, clusters, venture capital funds, etc. Tax incentives are also available at provincial level. |
| Czech Republic | Policy is centralised, regions have little responsibility in the STI domain. Several regions have established regional innovation strategies, of which cluster strategies are the main elements. The State Ministry of Regional Development has established a programme to support public R&D actors in the regions. Major contribution of EU Structural Funds (ERDF) for R&D and innovation financing. |
| Denmark | There is no formal regional government authority in Denmark (except in the health sector). However, regions gained a much stronger position on the innovation policy agenda as a consequence of the structural reform in 2006. The Danish Enterprise and Construction Authority (DEACA) has the responsibility for a number of regional development initiatives, also in relation to EU regional funding. "Regional growth fora" have recently been established (with the participation of up to 20 representatives from central stakeholders) responsible for strategic planning, monitoring and developing initiatives. The growth forums are not themselves implementing units. The initiatives that the growth forums wish to launch must therefore be implemented by others, for example municipalities, independent institutions or other independent legal entities. The regions receive a block grant, and the projects are co-financed, e.g. by EU Structural Funds, regional enterprises and governments and knowledge institutions. |
| Finland | Regions play a very limited role in terms of governance of innovation policy. Decentralised policy structures include regional offices and innovation clusters. Finnvera, a state-owned company providing risk-financing services, has 16 regional offices. There are 21 centres of expertise across the country. |
| Iceland | The regions do not hold competences in innovation promotion. Economic and knowledge-based activities are heavily concentrated in the capital. Regional knowledge centres are being established, gathering local branches of universities, public research organisations and support organisations, all funded by the national government. |
| Ireland | There is a limited role for the sub-national level in STI policy. Industry Led Research Networks is a pilot initiative with a regional dimension and county involvement. Through grants, proposals from industry networks/ groups of companies (comprising clients of Enterprise Ireland, IDA Ireland, Shannon Development, *Udarás na Gaeltachta* and County Enterprise Boards) it supports collaborative projects. |

Table 2.A1.1. **The regional dimension in national innovation strategies: selected OECD countries** *(cont'd)*

| Country | National innovation policy and regions |
|---|---|
| Italy | At regional level, there is no unique model to manage and implement innovation policy, as regions have some discretionary power in this field. Many regions have created regional innovation agencies with the task of funding and implementing innovation policy measures. Others have specific departments for innovation, or in some cases innovation is dealt with within departments that have a broader scope (e.g. economic development), where innovation policy might be less decisive.<br><br>An ongoing process of strengthening regional excellence is also pursued through decentralised policies and delegation of authority by the central state to regions over innovation policy design and implementation. "Technology districts" are key sectors jointly promoted by the government and the regions, as territorial entities which are systemically grouped by technology-intensive products and services. Twenty-four technology districts have been promoted so far in key strategic areas. |
| Netherlands | With the Peaks in the Delta programme, the national government provides funding for regional (NUTS 1 level) innovation policy. This has also increased the co-ordination between innovation policy from the various levels of governance (EU Structural Funds, national and regional). Funding from the regional authorities (NUTS 2, provinces) for innovation policy is very limited, but provincial governments play an important role in strategy development, co-ordinating grass-roots initiatives. |
| New Zealand | Policy is mainly national. Trade and Enterprise, a national agency, funds regional programmes (the central government works with regional governments in deployment). They include: Regional Polytechnic Development Fund, Regional Partnerships Programme, and Cluster Programmes. There are some initiatives at the regional level, such as the provision of business development services and the promotion of "knowledge-based cities". |
| Norway | Norway is a unitary state divided into 19 county administrations (*fylke*). The county councils and the municipalities form the regional governance system in Norway. Initiatives have been taken by some county authorities to develop research and innovation policies of their own. Since 2010, counties have acquired more formal responsibilities in STI: they own new regional research funds. The counties will also be responsible for selecting board members to university colleges in the region. Specific innovation-oriented programmes are available for counties in northern Norway. |
| Portugal | Limited competences and budgets for regions for STI initiatives. |
| Sweden | Research policy is decided at the national level, but in the latest government bills on regional policy, "Regional Growth – For Jobs and Welfare" and "A Policy for Growth and Vitality in the Whole Country" (2002), the co-ordination of research and regional policy was stressed, regarding development of clusters and regional innovation systems. Linking regional growth initiatives with national research and innovation policy includes improving the dialogue with regional actors and national authorities. |
| Switzerland | Responsibilities for HEIs are divided between the Confederation and the 24 cantons. The Swiss University Conference co-ordinates strategies between the two levels. Studies have reported a situation of "impossible co-ordination" between the two levels of governance. Cantons are responsible for economic promotion and support for SMEs, but do not develop explicit innovation policies. |
| United States | States launch the majority of innovation initiatives under the rubric of "technology-based economic development", while the federal government is the main funder of basic and applied research. The nature of state-level initiatives varies widely according to the orientation of economic development of each state: some fund major initiatives around the development of new technologies, others are engaged in operations targeting diffusion and absorption of technologies. |

*Source:* Adapted from Nauwelaers and Wintjes (2011), *Comparative Review of Innovation Policies*, report for the Lincoln University research programme "Studies in Technology User's Innovation", October, Canterbury.

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# Part I

## *Chapter 3*

## Multi-level governance of innovation policy

*Regions are embedded in a network of governance with formal and informal competences that determine the scope for regional innovation policy. The multi-level governance of innovation policy has become increasingly complex, thanks to several trends that highlight the role of regions for innovation. This mutual dependence brings to light challenges in multi-level governance that need to be clearly diagnosed to identify adapted governance arrangements and tools for vertical and horizontal co-ordination. Regions also need to engage the right public and private stakeholders, within the region and beyond, to implement their strategies. Adapted monitoring and evaluation tools not only serve these regional strategy needs, they also reveal relevant information for more effective governance co-ordination tools.*

## Introduction

Several trends are contributing to greater complexity and mutual dependence across levels of government with respect to innovation policy. National and supranational governments are developing strategies to reach their economic and innovation goals, and regions matter to achieve them (see Chapter 1). As regions develop their roadmaps and smart policy mixes, based on their own assets and strategic choices, they need to take into account their position in multi-level governance frameworks (see Chapter 2). That regional position may vary with respect to different aspects of science, technology or innovation (STI) policy and instruments.

However, there are many unresolved multi-level governance issues to be addressed. They include the policies and relationships across levels of government (vertical) that involve not only national and regional authorities but also sometimes supranational and local actors. They also concern governance within the regions themselves, across policy areas (horizontal). In this sense, governance does not mean government, as both public and private actors need to be mobilised for the regional roadmap. Greater coherence of STI policy, as well as leveraging private resources, is even more critical in the current context of tight fiscal budgets.

There is a lack of systematic information on how regions and national governments share competences, what challenges they are facing, and what capacities and tools they need to address these challenges. To build that evidence base, the "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy" (OECD, 2009a) was developed for policy analysis and guidance in this area (see Box 3.1).

### Box 3.1. **OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy**

The survey was developed to take stock of the role of regions in a multi-level governance context. It builds on research at the OECD on STI policy, particularly with respect to the role of the regional level, and on multi-level governance, with questions based on established OECD frameworks applied in other policy fields to analyse mutual dependence across levels of government. Most questions were in a structured format to facilitate cross-country comparisons. A few questions were left open-ended. Several questions addressed local authorities, as well as the supranational level (e.g. European Union, international development banks). Topics covered include:

- **Roles and budgets:** which level is most important with respect to STI policy in its different aspects? Where is this defined (or not)? What is the budget split between national/sub-national authorities, and how has this changed over time? What has the impact of the economic crisis been?
- **Challenges:** what are the key challenges in the country with respect to multi-level governance?
- **Co-ordination:** what are the current co-ordination tools used across levels of government with respect to STI policy? What is the relative importance of each tool?
- **Instruments:** which STI policy instruments are used at national level? Supranational level? Which instruments are used by some, most or all regional authorities? Local authorities? Which level of government takes the main role in managing or funding those instruments?

Box 3.1. **OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy** *(cont'd)*

- **Regional dimension of national STI policies:** is the regional dimension discussed in national plans? Are there measures to support regional capacity? Experimentation? Private sector leadership? Use of STI indicators at sub-national level?

**Respondents:** The survey was submitted to delegates of the OECD's Territorial Development Policy Committee (TDPC) in late 2009. Survey responses were returned in most cases in the first quarter of 2010. TDPC members represent their national governments. The ministry of origin varies from one country to another, which may influence the nature of certain responses. In some cases, the survey was forwarded by TDPC delegates to other public actors in their countries (including representatives of other OECD bodies, such as the Working Group on Innovation and Technology Policy) for comment or completion. Additional information was obtained in some cases by other experts to complement information received in surveys. The survey was also distributed to non-member countries via programmes on regional innovation at the Inter-American Development Bank and the Asian Development Bank.

The responses for OECD member countries include: Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Korea, Mexico, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom (England only). The four non-member country respondents include: China, Colombia, Sri Lanka and Vietnam. Not all countries responded to each question, so references in the text are to the proportion of responding countries.

## 3.1. Different regional roles in a multi-level governance context

To understand the different roles a region can play, it is important to clarify what a "region" is. Different levels of statistical and administrative (or political) regions are defined in the OECD. For the purposes of this chapter, the term region refers in almost all cases to the first tier below the country level, such as a state in the United States or a county in Sweden.[1] A functional region for STI policy, in terms of economic and innovation system linkages, may not match these administrative or political boundaries. In fact, they usually do not match, as by nature such linkages change more rapidly than administrative borders, which in some cases were defined centuries ago. Functional regions may be contained within a country, or may cross national boundaries. And while some functional ties between regional firms or universities may span the globe, many interactions occur at a more localised level, such as a city or metropolitan area.

### *Formal and informal roles are both important*

The role of regions in STI policy development and implementation derives from different aspects of STI policy competences. Regions may be active in: *i)* setting the overall strategy and framework; *ii)* developing policy; *iii)* financing policy; *iv)* implementing programmes and instruments; and *v)* assessment/evaluation (of strategies, programmes and instruments). Per the OECD-GOV Survey (OECD, 2009a), national governments were reported as being more important than regions for most of these factors, with a couple of exceptions in federal countries. Other exceptions are noted with respect to implementing policies, whereby a region may not be ranked as high as a national government on strategy-setting and financing, but may nevertheless play a key role in implementing policy.

The relative importance of regions in multi-level governance frameworks can also be influenced by supranational authorities. This is observed notably in some EU countries that are large recipients of Structural Funds. In those cases, countries ranked the supranational level as more important than the regional level in setting the framework or in financing of STI policy. The EU has actively supported the regionalisation trend generally, and some aspects of STI policy in particular. For example, many regional innovation strategy initiatives began through participation in EU regional policy programmes. Other programmes from the Directorate Generals of Research and Enterprise increasingly support a regional dimension in STI policies. International development banks, such as the Inter-American Development Bank and the Asian Development Bank, have also begun to work in this field, supporting regional innovation systems through studies, networks and funding.

The basic political structure of the country is an important, but not determinant, factor in understanding the scope for regional action. While an institutional framework (federal, unitary with elected regions, unitary with administrative regions) suggests one model or another, there are choices to be made about the role of the region within those governance arrangements. Regions may play a passive role, such as stages (scales for national action) or implementers (regions serve to deliver centrally conceived priorities and targets). They may also play an active role, such as partners (helping to design and finance national priorities) or independent policy makers (using own resources and independent agenda setting) (Perry and May, 2007).

Given the relative newness of certain aspects of STI policy, the formal definitions of regional roles are evolving. These definitions are codified in various ways, such as: constitutions, national S&T laws, national STI plans, other national laws or plans (in several cases with respect to regions more generally), and in a few cases, they are not defined at all (see Table 3.1.).

Table 3.1. **Formal definitions of regional role for STI policy**

| Constitution | S&T Law | Other laws, decrees or regulations | Not defined |
|---|---|---|---|
| Australia[1] | Korea | Denmark (regions) | Czech Republic |
| Austria | Mexico | Finland | Netherlands |
| Belgium | Colombia | France | Portugal |
| Germany | Vietnam | Hungary (regions and STI funds) | |
| Spain (also S&T Law) | Spain | Norway (devolution) | |
| Switzerland | | Poland (regions) | |
| United States[1] | | Sweden | |
| | | United Kingdom[2] | |

Notes: 1. Policy areas not defined in the Constitution are the responsibility of sub-national governments. 2. The structure of English regions in the United Kingdom is undergoing change.

*Source*: OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris.

Constitutions in several countries define the scope for regional competences in different policy fields. In a number of countries, this STI role may not be explicitly defined but rather fall to constituent regions (states, provinces, cantons, etc.) by default. In Spain, the Constitution explicitly articulates that the state has power to "co-ordinate and promote scientific and technical research." But even with a Constitution, there is evidence that the role-sharing between regions and national governments in several countries has changed in recent years, often through specific STI laws, or more detailed decrees and regulations.

Other laws and decrees may specify a regional role in STI policy. Countries that define responsibilities with an S&T law, such as some Asian countries or Mexico, further elaborate the role in this policy field that may not have been explicitly defined elsewhere. In several other European countries, other laws, including those related to regions more generally, give the sub-national level competences. Often these competences for technology and innovation policies stem from regions' responsibilities for economic development, a competency generally shared across levels of government in OECD member countries (OECD, 2007b; OECD 2009b). And in some cases the science policy stems from a regional role in financing research in higher education institutions, with an increasing recognition that spillovers to these science investments could accrue to the region if it introduced complementary policy instruments.

While the formal roles generally take a uniform status for all regions in a country, asymmetric decentralisation for STI policy can occur. In the United Kingdom, the devolved administrations (Scotland, Wales and Northern Ireland) have a more autonomous role, including for STI policy, relative to the English regions. In 2009, Spain delegated competences to the Basque Country for scientific and technological research and development, to be exercised in co-ordination with the State. This transfer of competences is accompanied by a transfer of resources. There are occasionally other special arrangements in OECD member countries generally for a capital city or district (such as for Helsinki, Finland); however, such cases do not necessarily have a direct link to STI policy.

Even if regions have similar formal powers, there may be *de facto* asymmetric decentralisation due to differences in regional capacity, financial or otherwise. In terms of instruments used, many countries report that only some regions use certain instruments, indicating different practices from region to region (see next section). For example, while Italy has passed a law allowing regions to take on innovation policy competences, only a few regions have seized such opportunities to play a more active role (OECD, 2009c).

Beyond the definition of policy competences, there are also national plans that discuss the role of regions in STI policy (see Table 3.2). That recognition of a regional role takes different forms, from a simple observation about the innovation process, a problem that needs to be addressed, or a way of working together with regions more generally:

- **Observation: *Innovation hubs and the spatial dimension of the innovation process*.** A few plans mention the importance of particular hubs around the country located in different regions, such as in France. The UK's 2008 report *Innovation Nation* also included a chapter on "innovative places" that recognised a "place-based" dimension to innovation.
- **Problem*: Regional disparities.*** Some countries highlight the regional disparities in STI performance. This mention usually implies that the strong disparities across the territory are considered problematic for national excellence in STI, as well as regional development more generally, such as in Hungary and Mexico. These disparities are therefore the domain for national governments when regional entities have an insufficient mandate or resources to address the problem themselves.
- **Modality of working across levels: *Partnership*.** Countries that have promoted this approach include Denmark, Norway and the United Kingdom (England). The

recognition of partnership supports efforts to inform national policy making and programme delivery. ***Alignment.*** There are countries that seek to promote greater coherence and alignment of spending across levels of government, particularly for countries where the regional level has more autonomy to spend its own funds, such as stated in plans for Austria and Canada. ***Separation of competences.*** The federal context in Belgium implies a separation of competences and no hierarchy between federal and regional competences.

Table 3.2. **Sub-national dimension of national STI-related plans**

| Country | Plan or strategy | Regional dimension | Focus |
|---|---|---|---|
| Austria | STI 2020 (2010) | Calls for coherence and mutual calibration among regional, federal and European activities | Alignment |
| Belgium | None | The three regions autonomously define their own STI plan | Separation of competences |
| Canada | Mobilising S&T to Canada's Advantage 2007 | Call for provinces and territories to align with federal plan | Alignment |
| Denmark | Progress, Innovation and Cohesion – Strategy for Denmark in the Global Economy (April 2006) | Partnership agreements between the regional growth fora and the central government to foster regional innovation and business development | Partnership |
| Hungary | Government's mid-term (2007-2013) Science, Technology and Innovation Policy (STI) Strategy | Enhancing the regions' research & development & innovation (R&D&I) capacity<br>Investment in large scientific facilities, primarily in the regional centres and the development poles, reducing regional differences (regional cohesion)<br>Strengthening regional innovation | Addressing regional disparities |
| Mexico | Special Programme for Science and Technology 2008-2012 | Strengthening of state S&T systems and innovation; increasing S&T and innovation infrastructure, both physical and human capital | Addressing regional disparities |
| Norway | White papers on: Innovation (December 2008) and Administrative Reform (December 2007) | Regionally differentiated innovation policy<br>National and regional co-ownership of Innovation Norway from 2010 | Partnership |
| United Kingdom (England) | Science and Innovation Investment Framework (2004) | Regional delivery with national advice and direction<br>National delivery with regional advice and input; inter-regional partnership (regional development agencies) | Partnership |
| United Kingdom (England) | Innovation Nation (2008) | Chapter 9 on "Innovative Places" raises the issue of a "place-based" dimension of the innovation process | Regional dimension of innovation |

*Source:* Country responses to OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris and additional research.

### *Public investment in STI: regional shares vary, but are high in some countries*

There are no harmonised statistics on the relative share of regional spending in total public R&D or STI-related expenditures, but there are some figures available (see Table 3.3). In countries such as Belgium, China and Germany, those shares of different aspects of STI spending (typically public expenditure on R&D) can be 50% or greater. In other countries, that share may be less than 10%, such as for Austria, a federal country, or Denmark, a unitary country. Such STI spending by sub-national levels are in a context of overall sub-national spending trends where regions play a large and increasing role (see Box 3.2).

Table 3.3. **Sub-national share of R&D and related spending**

| Country | Share of spending by regional level | Type of spending reported by country[1] | Source |
|---|---|---|---|
| Austria | 5.2%<br>(EUR 0.4 billion out of 7.7 billion) | For innovation support, R&D, HEI | *Austrian Research and Technology Report* (2009) |
| Belgium | 79% | Government Budget Appropriation for R&D (GBOARD) | *www.belspo.be* (2009 data) |
| Germany | Just over 50% | Public R&D expenditure | OECD Survey (2005 data) |
| China | Approximately 50%<br>(RMB 107/211 billion) | R&D and operating budgets for government and HEI research facilities | *www.sts.org.cn* |
| Denmark | 7%<br>(EUR 142 million/2 038 million) | R&D and innovation support (mainly research funding for universities) | Figures on research, 2008 (Tal om forskning, 2008) |
| Korea | Approximately 20%<br>(USD 2.7 billion/13.5 billion) | Mainly regional science and technology parks | *Regional S&T Yearbook* (2009) |
| Spain | Approximately 20% of the EUR 10 billion comes from regional governments | Public R&D&I spending by Spain and its regions | National S&T Plan (CICYT, 2007) |

Note: 1. Given the lack of common measures of spending at sub-national level, such as R&D spending defined by the OECD *Frascati Manual*, countries were asked to provide the figures they have and the type of expenses included.

*Source:* OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris and additional research.

The OECD-GOV Survey indicates that there has been a trend towards an increased regional share of total country STI spending. As countries do not typically track this share or its evolution systematically (using any country-specific definition, let alone internationally comparable definitions), country responses give some rough estimates. Countries reported almost uniformly an increase in the regional share over the last 5 years (14 countries out of 15), with several countries reporting that this share probably changed by more than 5% (6/15).

What has been the impact of the economic crisis? Countries reported that due to the crisis, there were: no changes in allocation across levels of government (4 countries out of 19), short-term changes (14/19) and/or long-term changes (3/19).[2] Of those reporting a change, 10/19 reported increased STI spending and 6/19 reported a decrease in STI spending. Increases in spending associated with the response to the crisis were attributed to the national level in all but one case. Such increases may be attributed in part to different national stimulus packages that included an STI element (Guellec and Wunsch-Vincent, 2009).[3] When a decrease in spending occurred, there was no trend in which level of government was generally responsible, since, depending on the country, responses included national, regional or local levels. Countries and regions face tension in the context of the crisis between spending for short-term impacts rather than the long-term impacts that many STI-related investments can produce.

Interpreting the share of spending in regional budgets on STI is not straightforward either. Regions with greater levels of resources or control over their own resources may have more flexibility in orienting regional funds to STI policy priorities. But regional governments are also gap fillers, seeking to spend funds where national funding flows for STI policy are not sufficient. For example, regions in the North of England allocated a higher share of their regional development funds to STI needs than several other English regions, in part to address the lower level of spending flowing from national level STI policies (OECD, 2008). Some countries have data on the share of regional spending on STI using a harmonised calculation, such as in Spain, where regions were reported to spend between 0.55% and 3.14% of regional budgets (FECYT, 2009).[4]

### Box 3.2. **Sub-national autonomy in spending in OECD member countries**

Regional spending on STI policy is embedded in overall public finance trends. In terms of public spending and capital investments in all categories, sub-national governments in OECD member countries account for an important share. The average sub-national share of spending was 32.8% in 2009, ranging from 65.1% in Canada down to 5.8% for Greece.[1] The share in public investment (gross fixed capital formation) is almost double that figure, with an OECD average of 65% in 2008, ranging from over 70% in Canada and Belgium down to 22% in Greece (see Figure 3.A1.1). The sub-national share of general government expenditures has risen over the last several years, outpacing increases in the sub-national share of revenues in many countries. The vertical fiscal imbalance (difference between sub-national government expenditures and tax revenues) is therefore increasing in many countries.

However, these figures for spending on all functions are misleading with respect to STI for two reasons. First, the share of sub-national spending differs by policy field; therefore extrapolations for STI policy are not possible. For example, the sub-national share of spending in Environment Protection and Health is over 50%, while for Social Protection the sub-national share is less than 20%.

Second, sub-national spending in any policy field does not sufficiently capture the real spending "autonomy" of regions. Central government regulations and policies may determine in part the way regions spend their funds. An analysis of different forms of autonomy reveals how complex the picture can be. It finds that with education, for example, where the share of sub-national government spending is large, there is nevertheless low autonomy with respect to that spending. Different forms of autonomy include:

- **Policy autonomy:** to what extent do sub-central governments exert control over main policy objectives and main aspects of service delivery (e.g. are sub-central governments obliged to provide certain services)?
- **Budget autonomy:** to what extent do sub-central governments exert control over the budget (e.g. is expenditure autonomy limited by earmarked grants or expenditure limits)? The stringency of fiscal rules could also be assessed here if linked to individual policy areas.
- **Input autonomy:** to what extent do sub-central governments exert control over the civil service (staff management, salaries) and other input-side aspects of a service (e.g. the right to tender or contract out services)?

Box 3.2. **Sub-national autonomy in spending in OECD member countries** *(cont'd)*

- **Output autonomy:** to what extent do sub-central governments exert control over standards such as quality and quantity of services delivered (e.g. the right to define school curricula, the right to set up a hospital, the right to define prices for local public transport, etc.)?
- **Monitoring and evaluation:** to what extent do sub-central governments exert control over evaluation, monitoring and benchmarking (e.g. financial control, school tests, etc.)?

Note: 1. General government revenues and expenditures are broken out among: *i)* central government; *ii)* sub-national governments (local and, when available, intermediate); and *iii)* Social Security. As the share attributed to Social Security varies widely between countries (from 45.3% of spending in France to 4.4% in Denmark), this has a significant impact on the remaining shares attributed to central and sub-national governments.

*Source*: Data from OECD *National Accounts*; Bach, S. *et al.* (2009), "The Spending Power of Sub-central Governments: A Pilot Study", OECD Network on Fiscal Relations Across Levels of Government, COM/CTPA/ECO/GOV/WP(2009)8, OECD, Paris; Bell, M. *et al.* (2007), *Measuring Fiscal Decentralisation: A New Perspective*, The World Bank, Washington, DC.

### *Many regions and national governments are using the same policy instruments*

Certain STI instruments are reported to be more commonly used at one level relative to another (see Table 3.4). In terms of high-level strategic bodies and technology foresight exercises, regions are almost as active as national governments. Regions are also financing R&D in public entities, but to a somewhat lesser extent in private entities. Technology transfer activities and innovation advisory services to existing and start-up firms are promoted by regions in most reporting OECD member countries. Programmes to support clusters and excellence hubs are frequently used at both levels, but more so at regional than national level. Incubators as well as science and technology parks are also more common at the regional than at the national level.

Some policy instruments are more frequently used by national governments. Scholarships for postgraduate studies were reported to be twice as common at national relative to the regional level. R&D investment is another area where national governments are much more active, notably for public subsidies to private R&D (almost twice as common) or tax credits for private R&D (more than three times as frequent). Promotion of scientific co-operation is more common by national governments, but more than half of the reporting countries nevertheless also use this instrument at the regional level. Financing via public development banks, public venture capital funds and guarantees are also more common at the national level relative to the regional level.

The local level is active in certain instruments.[5] This is particularly true for large cities (metropolitan areas) that have the scale, resources and sophistication to implement them. The municipal level may also be more important than the regional level for certain policies related to technology and innovation, such as in Finland. Even in countries with a strong regional level, like the provinces in Canada, some local authorities are reported to use many STI (generally innovation) instruments. The most common instruments reported at local level (in at least some localities in the country) include science and technology parks as well as incubators for firms. Support of international trips to develop networks, targeted human resource training, cluster initiatives, advisory services for innovation and start-ups, and other technology transfer centres were also reported in several countries at local level.

Table 3.4. **Number of countries reporting use of STI instrument by level of government**

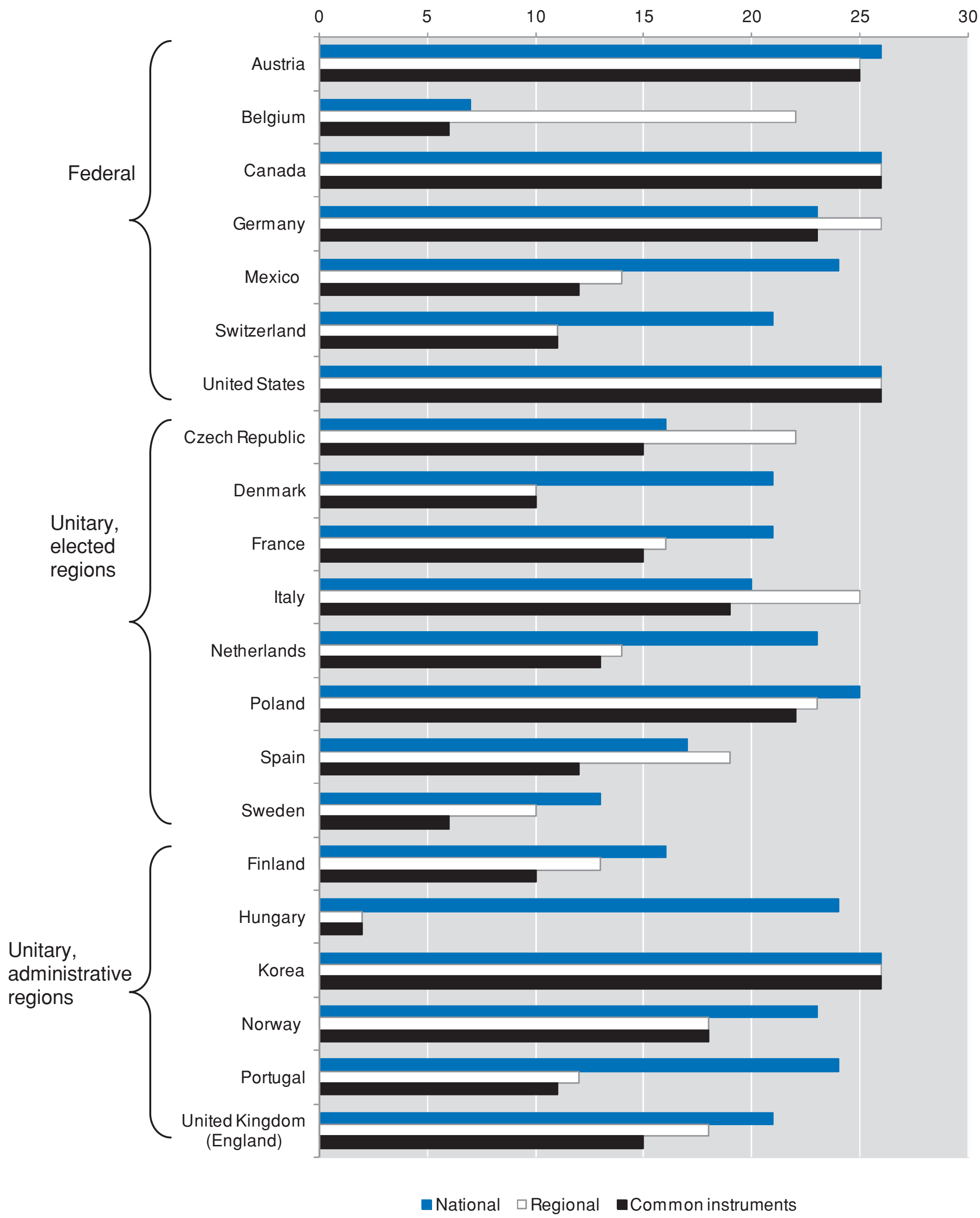
| | National level | Regional level |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for postgraduate studies | 21 | 11 |
| Targeted human resource training (directly, subsidies) | 18 | 14 |
| **Strategy and foresight** | | |
| High-level strategic advisory body | 20 | 16 |
| Technology foresight exercises (assessing future needs) | 18 | 17 |
| **R&D investment (including large infrastructure)** | | |
| Ongoing institutional R&D funding in PRCs or HEIs | 21 | 16 |
| Seed funding/projects to start PRCs or HEIs | 16 | 15 |
| Competitive R&D funding by PRCs or HEIs | 21 | 14 |
| Public subsidies for private R&D | 21 | 12 |
| Tax credits for private R&D | 19 | 6 |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | 17 | 10 |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | 20 | 19 |
| Advisory to spin-off and knowledge-intensive start-up firms | 19 | 18 |
| Other technology transfer centres and extension programmes | 18 | 16 |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | 19 | 22 |
| Branded excellence poles or hubs (label and multiple actors) | 19 | 20 |
| Multi-disciplinary technology platforms | 15 | 13 |
| Science and technology parks | 16 | 19 |
| Incubators for new firms | 15 | 21 |
| **Financing for innovative firms** | | |
| Public development banks | 15 | 9 |
| Public venture capital funds or stakes in private funds | 20 | 15 |
| Guarantees | 17 | 10 |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | 21 | 14 |
| Foreign firms eligible for public innovation-related funds | 15 | 11 |
| International trips to develop innovation networks | 14 | 17 |
| **Other programmes** | | |
| Public procurement policy with innovation focus | 15 | 11 |
| Innovation awards | 16 | 14 |

Notes: PRC=public research centre; HEI=higher education institution.

*Source*: OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris.

Many of the "same" instruments are used by more than one level of government in the same country (see Figure 3.1). There is not a strict division of labour across levels in terms of STI instruments. Country structure (federal, unity elected regions, unitary administrative regions) does not appear to determine the number of instruments at regional level or the share in common with national level. Austria, Canada, Korea and the United States, for example, report that both national and regional governments use not only many instruments, but also the same types of instruments as the national level. Countries with a fewer number of instruments at regional level, such as Denmark or Sweden, nevertheless show that all or almost all of those instruments are also used at national level. In the case of Belgium, where the national level has fewer instruments than the regional level, several instruments are nevertheless also common, such as R&D funding and scholarships.

Figure 3.1. **Number of instruments used by national and regional governments, by country**




Notes: National refers to the number of instruments used at national level, regardless of whether they are used at other levels. Regional refers to instruments reported at regional level, regardless of whether they are used at other levels. Common instruments refers to the number of instruments reported at both national and regional level, which includes those instruments reported in the tally of national and regional instruments.

*Source:* OECD (2009), “OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy”, GOV/TDPC/RD(2009)9, OECD, Paris.

The survey also sought to identify when such instruments were promoted independently by each level or jointly through a co-financing or co-management arrangement. In some countries, such as France and Korea, the instruments at regional level were reported to have significant financial support from national level. The same is true for Mexico, which is a federal country that nevertheless actively uses co-financed and/or co-managed STI programme funds. And in several Eastern European countries, the role of EU Structural Funds is significant in terms of Operational Programmes that help finance the instruments available in regions.

Another explanation for the large number of instruments reportedly used in common at both levels is the diversity of ways an instrument may be used. This is not only a question of spatial scale, but also the specifications of the instrument (see Chapter 6). For example, some technology centres can be targeted at high-tech sectors and financed and/or managed by national level, while some regional governments may also promote technology centres for sectors considered of a lower technology level. So an instrument may have the same name, but have a different configuration, target group, territorial scope or operating approach.

Quantitative evidence can reveal distinctions in the target groups and firm profiles based on use of instruments offered at different levels of government. One study of public innovation programme use by firms in Catalonia (Spain) found variations in firm behaviour given the different target groups for instruments. Firms that received public support from domestic sources (national and to a slightly lesser extent regional) displayed an increased likelihood than other firms to co-operate with national or international partners. National and regional programmes also increased the probability that firms develop product innovations (i.e. the introduction of a new or significantly improved good or service). Regional programmes further supported changes in process innovation (i.e. the implementation of a new or significantly improved production or delivery method for an existing product or service, including changes in techniques, skills, equipment and/or software). Firms that participated in national and international pre-competitive programmes were more likely to have patented, while firms that use other forms of intellectual property protection rather than patenting were more likely to participate in national (as opposed to international) programmes (Fernández-Ribas, 2009).[6]

This use of common instruments can also occur at the same level of government. In several countries, such as France, Japan, Norway and Sweden, there are multiple national-level cluster programmes to address different constituents, sometimes managed by a different ministry or agency. This situation can occur at regional level, as in Wallonia (Belgium) where there are two cluster programmes with different aims, scope and target groups. When there are two policies for clusters/excellence hubs, one often targets universities or other research-intensive clusters selected on excellence-based criteria, while the other supports clusters that are less developed or that have a more industrial focus (OECD, 2007a).

In the concept of a policy mix across levels of government (see Chapter 2), it is helpful to distinguish between healthy and wasteful cases where both levels use similar instruments.

- **Healthy (complementarity):** minor levels of redundancy across levels are difficult to avoid and may reinforce system stability. When there is a duplication, it may be attributable to: complementarity in the way the instruments are structured in terms of their target actors or purpose on a continuum of service needs; mutually accepted eligibility criteria; or co-financing of the instrument. For example, innovation support services are reported in most countries at both national and regional levels. Often at regional level, such services are targeted to SMEs that are not in high-technology sectors, while national-level innovation support services are intended for high-technology sectors.

- **Wasteful (excessive redundancy):** excessive redundancy can be attributed to: a lack of awareness of the instruments developed at another level of government; a failure to distinguish between target groups or topics in the instruments offered; and excessive complexity preventing the intended beneficiaries of the policy instrument (i.e. firms, research institutions, etc.) from understanding the public offer of support. Instruments at one level may also be developed to address problems created by policy from another level. In one OECD member country, the national and regional entities were required to reduce the number of different innovation support services and to register them with a nationally sponsored but regionally administered platform. This process served to reduce excessive redundancy and make the public offer to firms transparent.

## 3.2. Promoting complementarity across levels of government

### *A number of challenges arise with respect to vertical governance of STI policy*

#### *Recognition of regional STI priorities or assets in national policy approaches*

National policies determine significant STI resource flows to actors in regions. However, national priorities or policy approaches often do not know or recognise particular regional strengths. There are debates over what constitutes a national versus a regional priority, or whether an asset is "world class" and merits national, as opposed to only regional, support. Regions are orienting their strategies, at least in part, towards national and supranational objectives for recognition and accompanying resources. The fact that many regions prioritise the same sectors, for example, is also a rational response to objectives and funding flows from higher levels of government.

Calls for proposals and other competitions to designate regional strengths are used in many country contexts. Often these competitions result in rating systems and labelling that indicate whether certain assets or sectors are considered to be of national, as opposed to regional, significance. For example, France's *Pôles de compétitivité* programme labelled certain clusters of international significance (and hence a priority for the national government) and national significance (a priority for the region). The periodic Research Assessment exercise in the United Kingdom ranks university departments and has an influence on national research funding flows. Other examples include the Networks of Competence (Germany), VINNVÄXT clusters (Sweden), or knowledge clusters/industrial clusters (Japan). Such designations also serve to align resources across levels of government around common objectives.

#### *Regions need to map different financing sources behind a coherent strategy*

Regions are combining resources from several origins. Funding for STI-related activities may come from different levels and different sectoral ministries at the same level (see Table 3.5). Many regions therefore try to fill the gap when resource flows from other levels are not sufficient. Regions with little independent resources or STI policy competences are more dependent on the different national, or supranational, programme funds. Regions need to pool together the different programmes and instruments into this multi-level smart policy mix.

Table 3.5. **STI funding flows by level of government**

| | Local | Regional | National | Supranational |
|---|---|---|---|---|
| "S" science and research policy (may include higher education policy) | Not generally, but some instruments may support this | Some countries | All countries | EU; some international development banks beginning to be active |
| "TI" firm-oriented innovation and technology policy (generally includes enterprise and industry-related policies) | Yes, some localities are active in related instruments | Most countries, especially in the context of economic development responsibilities | All countries | EU; international development banks already active |
| Regional development policies (may be in one ministry or dispersed across different ministries) | Not generally, as spatial planning issues at local level are not focused on STI | Some regions are trying to reduce disparities in their territory | Most countries, although this is not an explicit policy domain in some countries | EU; some international development banks active |

*Proliferation of public support programmes (transaction costs, complications for target groups)*

The proliferation of policy streams and levels of government has also created a complicated landscape of support programmes for beneficiaries (firms, research institutions, etc.). Efforts to rationalise the programme offer across levels of government are complicated to implement. For example in the United Kingdom, the Business Support Simplification Procedure aimed to reduce an estimated 3 000-plus publicly funded business support schemes throughout the country to 100 or less by 2010. As an alternative to rationalisation, one-stop-shops and "brokers" are often used to assist firms, mainly SMEs, in accessing the spectrum of programmes or services available in the public and private sector. Regional innovation agencies are helping to serve this role in many regions (see Chapter 5).

### *Diagnosing the multi-level governance challenge to select the right co-ordination tools*

The three examples cited of STI co-ordination problems may be symptomatic of structural multi-level governance problems that need to be properly diagnosed. A diagnostic tool applied to other policy fields may be helpful to countries in understanding the source of their own multi-level challenges in STI policy (see Table 3.6). The OECD-GOV Survey asked national governments to rank the sources of common challenges (derived from this diagnostic tool) according to their severity (including an open-ended "other" option):

- Information sharing across levels of government to inform each other's policy is difficult;
- capacity at sub-national level to formulate and deliver policy is lacking;
- financial resources are insufficient for certain regions/localities to actively participate;

Table 3.6. **Diagnosing multi-level governance challenges**

| Diagnostic consideration | Description | Common problems in STI policy |
|---|---|---|
| Fiscal | Occurs when sub-national revenues are not sufficient to finance the required expenditures, indicating a direct dependence on higher levels of government for funding in order to meet obligations. | Insufficient regional resources may limit spending on complementary measures that matter for the effectiveness of national STI policy (all regions or those economically disadvantaged).<br>Sub-national governments in crisis periods are under strong pressure to shift away from long-term STI-related investments towards spending for immediate needs. |
| Administrative | Arises when administrative borders do not correspond to functional economic and social areas at the sub-national level, leading to a fragmentation of public policies. | Functional boundaries of clusters or innovation systems may be cross-regional (either within a country or across national borders).<br>The footprint of such functional areas may also be at the scale of a metropolitan area where a political or administrative entity with appropriate instruments does not exist. |
| Capacity | Arises when there is a lack of human, knowledge (skill-based and "know-how") or infrastructure resources available to carry out tasks, regardless of the level of government. | STI is a relatively new policy arena for many sub-national governments, implying greater potential capacity challenges.<br>Policy makers lack capacity to work across levels of government in this increasingly shared policy domain. |
| Objective | Different "rationalities" (perspectives) create obstacles for adopting convergent targets. | Objectives at a national and regional level may not be aligned, due to different perspectives (e.g. a region's prioritised cluster/technology is not a national priority).<br>Adoption at regional level of targets set at a higher level of government may not be appropriate (such as a 3% R&D intensity). |
| Policy | Results when line ministries do not account for the complementarity across sectors needed for cross-sectoral policies. This can require co-design or implementation at the local level. It may also result in a competence being missed at a particular level of government. | STI is a field often covered by two or three ministries or agencies at national, regional and even supranational levels.<br>At regional level, there are greater challenges to overcome lack of horizontal co-ordination at higher levels. Vertical co-ordination efforts are also hindered.<br>Importance of complementarity in the policy mix, as one instrument (incubators) may require another instrument (start-up firm financing) to be effective, and these instruments may be coming from different levels of government. |
| Information | Occurs when different levels of government do not have the relevant information when designing, implementing and delivering policy. | Information on regional innovation system actors is better known at regional and local levels.<br>Even at sub-national levels, information may be held by private actors (such as brokering institutions, universities, etc.).<br>Regional policy makers may have only a partial view of national and global trends. |
| Accountability | Difficulty of ensuring the transparency of practices across the different constituencies. | In STI policy, including at regional level, there is often a lack of political ownership (the policy field is less visible to the general public).<br>Trends towards increasing expectations of regional STI policy for meeting economic and social goals may support greater transparency. |

*Source*: Adapted to STI policy from OECD (2009), *Bridging the Gaps between Levels of Government*, Policy Brief, OECD, Paris.

- administrative boundaries at regional and city/local level are an impediment to policy efforts;
- policy silos at supranational/national level undermine efforts to co-ordinate at the sub-national level;
- inefficiencies are high given the proliferation of programmes emanating from different levels; and
- gaps in the allocation of responsibilities result in policy areas unmet at any level of government.

The relative importance of the perceived challenges varies widely across countries, with no pattern by country type, but the remedies will depend on country type. There are both federal and unitary countries that considered information sharing and policy silos as highly important. And the same is true for insufficient funds and capacity at sub-national level. The remedies will therefore depend on the degree of STI policy devolution in terms of the region's true role in multi-level governance frameworks.

With respect to capacity building, nearly all reporting countries indicated that there were national policy efforts to support STI capacity in regions. Different vehicles for supporting such capacity included (in descending order of response frequency): *i)* incentives to develop regional innovation strategies; *ii)* national funding to targeted region types (in some cases leading, in some cases lesser developed); *iii)* training; and *iv)* devolution of policy making or spending responsibilities. EU Structural Funds have been active in this capacity-building function and supported most of the methods cited.

Selection of the right co-ordination tool depends on the underlying problem as well as a country's legislative or institutional structure as well as convention. For example, if the challenge is financing, this can be addressed in several ways. Project-co-financing is one option adapted to the selection of a limited number of investments that should be shared across levels of government (such as public-private partnerships in strategic technologies or clusters with significant R&D expenses). Contracts to provide financing may take many forms. They can be used for more complex investments (such as a large-scale scientific installation) or to finance a broader set of initiatives when regions lack their own finances to do so. Alternatively, if the problem is building regional policy-making capacity, other tools may be more relevant. A multi-level government regional agency is one option for progressive learning. Contracts are another useful instrument, because, if structured properly, they involve significant information sharing and dialogue both initially and throughout the process on what is working and what is not. The design of the tool will also determine its effectiveness. Some considerations for good practice lessons for using these tools are summarised in Table 3.7.

Table 3.7. **Implementing co-ordination mechanisms for the multi-level governance of STI policy**

| | Primary benefits | STI policy implementation considerations |
|---|---|---|
| Regular dialogue | Promotes information sharing at a given level or across levels to support STI policy development.<br>Builds trust through repeated interactions.<br>Allows for flexible adaptation over time. | Sufficient regularity is needed to maintain relationships and support regular feedback.<br>A "neutral" or respected entity can sometimes be helpful for playing the convening role for dialogue.<br>Consider mechanisms for input from private actors (not only public). |
| Consultation process | Process for providing feedback (generally by regions to national government) at key stages in development of an STI Plan, S&T Law, etc.<br>Formalisation enshrines practice beyond political cycles. | High-level political consultation processes can reveal conflicting objectives in other policy areas.<br>Accompanying work groups of practitioners to follow up in between consultations on STI policy has been found useful in several countries. |
| Agencies (multi-level) | Joint implementation of overall strategies.<br>Helps to identify bottlenecks and complementarities for overall STI policy mix. | Opportunity to pool funds across departments at a higher level of government, discouraging policy silos problematic for the lower level.<br>Many choices need to be made on the role of agency that influence capacity to build bridges across levels of government. |
| Contracts | Addresses fiscal imbalances (*ad hoc* or strategic).<br>Promotes inter-governmental dialogue in contract development process.<br>Information is shared periodically, including through commonly agreed indicators.<br>Encourages convergence of objectives.<br>Contracting process can build policy-maker capacity. | Opportunity to pool funds across departments at a higher level of government, discouraging policy silos problematic for the lower level.<br>Anticipate an impact-oriented, as opposed to audit-oriented, review of contract performance for policy learning. |
| Project co-financing | Supports joint action across levels of government.<br>Addresses fiscal imbalances (*ad hoc*).<br>Encourages convergence of objectives (*ad hoc*). | When higher level selects co-financed project, it should consider the project's integration into broader regional/local strategies.<br>Consider whether design of co-financing mechanism adds or reduces to transactions costs of programme implementation. |
| Territorial representatives | Provides national government with an access point on regional issues and vice versa. | Representatives may have ties to individual ministries in capital but need additional incentives to co-ordinate with other representatives in the same region.<br>Representatives could be invited to participate in key regional boards to promote greater intergovernmental information sharing. |

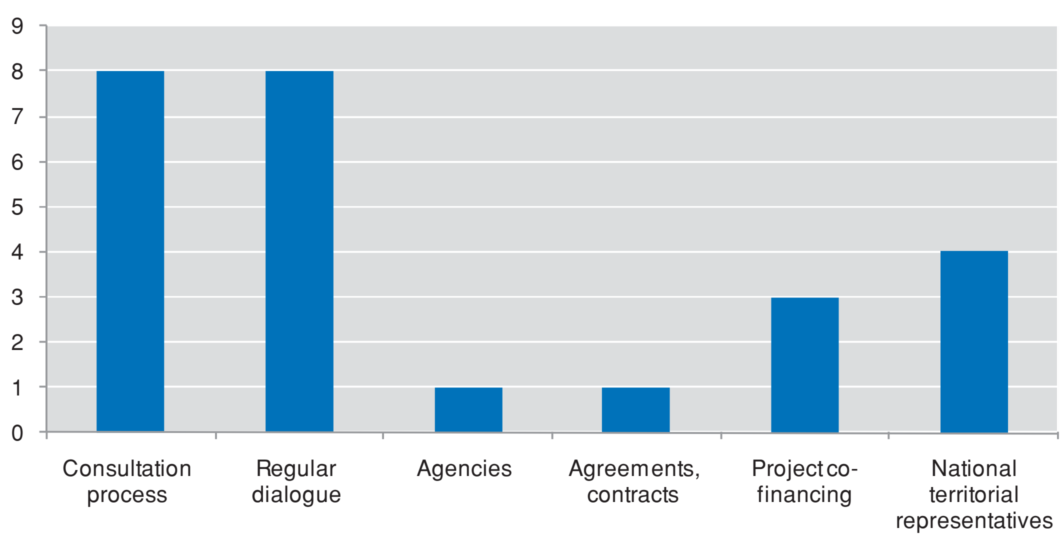
### *Commonly used co-ordination tools: country practices*

Countries report that the most important co-ordination vehicles for STI policy are actually those that are not always formalised (see Figure 3.2). Both consultation processes (formal and customary) as well as regular dialogue were rated as most important among reporting countries. This is true for most federal countries and some unitary countries. National territorial representatives were also reported in several countries. Typically this is reported as the most important tool by those countries with a more centralised planning approach to regions. For regional development policy more generally, contracts are among the most commonly used instruments (OECD, 2010b). While many countries use this tool in STI policy, it is not generally ranked as the primary instrument for co-ordination.

When all co-ordination mechanisms are considered, the trend is for most countries to use several tools simultaneously. This fact illustrates the importance of different vehicles for networking among public actors. There is no clear relationship between the type of country institutional structure (federal, unitary with elected regions, unitary with non-elected regions) and the number of multi-level co-ordination tools used. Of the six choices, almost all countries use at least four or more of these tools (see Figure 3.3). Legal mechanisms and standard-setting are important co-ordination tools generally for multi-level governance, used in many fields such as education and water resource management. However, it is perhaps not generally an appropriate tool for multi-level governance of STI policy, given the uncertainty with respect to the innovation process, which limits regulation of standardised innovation outcomes across regions.

Figure 3.2. **Most important co-ordination tool**

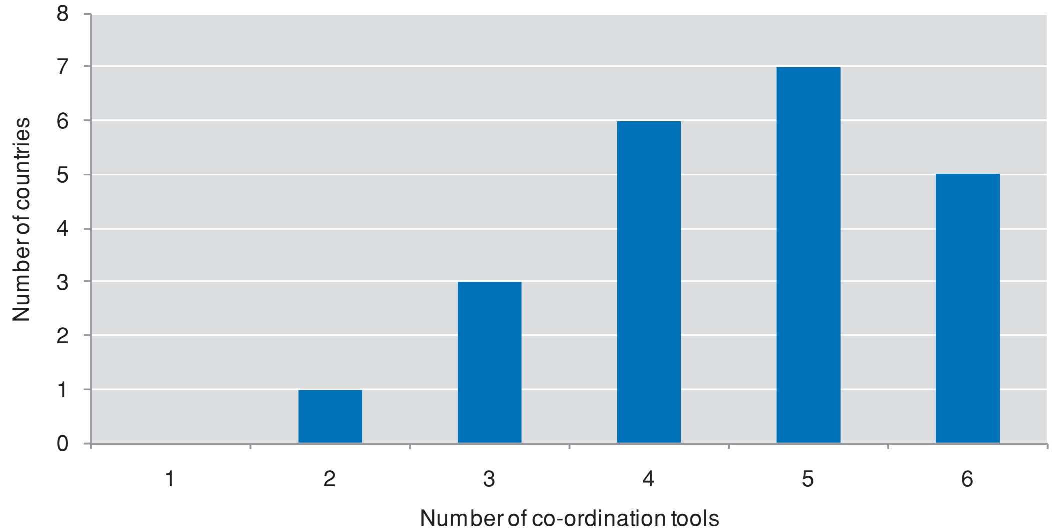
Number of countries reporting




Notes*:* Twenty-four reporting countries (20 OECD member countries, 4 non-member countries), one country reported two top tools.

*Source*: OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris.

Figure 3.3. **Number of multi-level governance co-ordination tools used in a given country**




Note: Responses available for 22 countries.

*Source*: OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris.

### *Bodies for multi-level dialogue and consultation*

In many OECD member countries, regular dialogue and consultation processes are reported as being of high importance for STI policy co-ordination. This dialogue occurs at political, high-level policy and practitioner levels. Several countries have an overarching political body for national/sub-national relations (covering many policy areas), but OECD case studies and Survey results illustrate that they are not typically an effective forum for co-ordination on STI policy.

Some countries manage this dialogue around flagship regional development programmes that include innovation. Finland's Centres of Expertise Programme serves as a forum for regular dialogue with representatives from national, regional and local institutions. In the Netherlands, the Peaks in the Delta Programme Committees support national-regional dialogue. In Denmark, the annual meetings between central government and the Regional Growth Fora serve a key consultation role. In Poland, the Monitoring Committee for the Regional Operational Programmes serves this function. In France, this dialogue is part of the development of the contracts with regions (see below).

National S&T-related plans provide a forum for consultation and alignment in several countries. This is true for the latest UK Science and Innovation Investment Framework, which is developed for a ten-year period with input from national departments and regional development agencies. Others involve more regular meetings, such as for the development and monitoring of Portugal's Technological Plan.

*Ad hoc* meetings and working groups are cited by many countries in promoting such dialogue, in addition to formal consultation processes. Formal processes, whether by law or convention, are used in many countries, such as Austria, Belgium, Germany, Korea, Mexico and Spain (see Box 3.3). In Canada, this dialogue between federal actors (Industry Canada and the regional development agencies) and the provinces is on an "as needed" basis. Denmark has many *ad hoc* meetings among civil servants across levels of government. The United Kingdom has also used meetings and working groups at multiple levels to promote dialogue (see also Box 3.3).

### Box 3.3. STI policy co-ordination mechanisms: *ad hoc* and formal consultation

- In **Austria**, there are several bodies for consultation and dialogue that meet regularly but are more self-organised than formally required.
- In **Belgium**, where the competences for STI are fully decentralised, the body for co-operation between federal and regional authorities in this policy area does not serve as a platform for policy dialogue or co-ordination. Rather, it restricts its activities to the development of joint positions and participation in international R&D activities (typically the EU Framework Programme) and the production of R&D statistics.
- **Germany**'s Joint Conference for Science has as its mission to co-ordinate R&D policies across regions and with international policies. It addresses co-financed programmes as well as those exclusively the competency of one level. Several other formal bodies in Germany such as the German Council of Science and Humanities and the Federation-*Länder* Committee on Research and Technology further promote dialogue across levels of government for STI policies.
- **Korea**'s National S&T Council involves several national ministries as well as the 16 regional governments.
- In **Mexico**, such formal consultation occurs via the National Conference of Science and Technology, which also promotes regular dialogue between national and state level S&T councils.
- In **Spain**, a 1986 Law[1] created the General Council for Science and Technology (*Consejo General de la Ciencia y Tecnología*) charged with promoting co-ordination for science and technology among the regions and between the regions and the State, although the current format does not promote active dialogue.
- In the **United Kingdom**, active dialogue was established in England, bringing together regional Science and Industry Councils (business and research leaders in the region helping with regional strategies) and the central-level Technology Strategy Board. The incentive for this close co-operation was a requirement by central government to align resources between the Board and regional development agency (RDA) spending.[2] One positive by-product of the resulting series of group and bilateral meetings has been a greater understanding by the central level and other regions of the regional assets and vocations across England, serving to increase trust across levels. At the practitioner level, a group called Regional Innovation, Science and Technology (RIST) brings together RDAs and devolved administrations with central government as a very active forum for information sharing, with several meetings annually. The National Endowment for Science, Technology and the Arts (NESTA) also provides research and events that promote national-regional dialogue on STI.

Note: 1. This law is likely to be superseded by a new law in 2011. 2. Changes to the regional development agency system in the United Kingdom were under way at the time of writing.

*Source*: OECD (2008), *OECD Reviews of Regional Innovation: North of England, United Kingdom 2008*, OECD Publishing, Paris, doi: 10.1787/9789264048942-en; OECD (2009), *OECD Reviews of Regional Innovation: 15 Mexican States 2009,* OECD Publishing, Paris, doi: 10.1787/9789264060135-en; and OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris.

### *National-regional development and innovation agencies*

Regional development agencies (RDAs) with strong linkages between central and sub-national governments are also being used in several countries to support co-ordination for STI policy. RDAs in England in the first decade of the 2000s, financed by multiple national government departments but with a Board of regional actors, increasingly supported different aspects of innovation. These RDAs were also on the boards of national STI governance entities. They developed independently their regional innovation strategies (OECD, 2008). In the Netherlands, the Ministry of Economy (responsible for both innovation and regional development policy) is a shareholder in three regional development agencies along with provinces. Finland's new Centres for Economic Development, Transport and the Environment (ELY centres) are national entities reporting to the Ministry of Employment and the Economy as well as the Finnish Funding Agency for Technology and Innovation (Tekes) that work in close co-operation with regional councils and cover innovation-related programmes.

In Canada, the federal RDAs play a role in facilitating the achievement of innovation policy outcomes through several mechanisms. They include: delivering federal S&T funding on behalf of the responsible federal department; facilitating interaction between local SMEs, training institutions and the provincial and federal players in the territory; delivering key infrastructure investments that affect regional/local innovation capacity; acting as the interface with the provincial and sometimes municipal levels of government on innovation policy issues; and advising relevant innovation policy responsibility centres on specific issues in their region.

Several OECD member countries have other entities, beyond consultation bodies, that serve to bring actors from both levels together in policy definition and execution. Hungary's Ministry for National Development and Economy has networks of both regional innovation agencies and regional development agencies. In the implementation of EU operational programmes, Poland's Ministry of Science and Higher Education has an agreement with the Polish Agency for Entrepreneurship Development (under the Ministry of Economy) to support innovation policy. Regional financing institutions help manage this process. CzechInvest, an agency of the Czech Republic's Ministry of Industry and Trade, has regional offices that support STI policy implementation. Joint institutions, such as those being developed in Norway, are innovative approaches to supporting national-regional joint action in STI policy (see Box 3.4).

#### Box 3.4. **Innovation Norway and regional research funds: national-regional engagement in STI**

Norway has recently initiated a creative approach to national-regional co-ordination through joint ownership of a national agency. Launched 1 January, 2010, Innovation Norway is 49% co-owned by the county municipalities (regional level). Hence, the regional responsibility for design and funding of Innovation Norway's programme portfolio (covering substantial parts of the innovation policy) will increase. In addition, 7 new regional research funds with a total capital of approximately EUR 715 million were launched at the same time. The expected annual return on the endowment (approximately EUR 26 million in 2010) is available for activities that will, among other goals, strengthen the regional research capacity through developing more competent R&D institutions in all regions. The new research funds are also available for projects in both the private and public sectors. The county municipalities are in charge of administration and direction of the funds.

*Source:* OECD (2009), "OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy", GOV/TDPC/RD(2009)9, OECD, Paris.

### *National territorial representatives*

National territorial representatives are used in a few OECD member countries. In France, beyond the overall prefecture structure, there are also representatives of the State in each region specifically for STI policy (the *Délégation régionale à la recherche et à la technologie*, or DRRT, and *Direction régionale de l'industrie, de la recherche et de l'environnement*, or DRIRE). They report primarily to their individual ministries but also to the regional State representative (*Préfet*). English regions in the United Kingdom in the past had "government offices", representatives of the central government, but other bodies directly related to STI policy fulfil the role of co-ordinator. In Portugal, sectoral ministries co-ordinate policies in each administrative region through the CCDR (Commissions for Regional Co-ordination and Development), which are the territorial representatives of the Ministry of Environment, Spatial Planning and Regional Development. The mandate of the CCDR includes promoting regional competitiveness and innovation. Korea's Ministry of Education, Science and Technology and Ministry of Knowledge Economy also have territorial representatives who support STI policy co-ordination. In Mexico, several important ministries have presence in the states, but they report back to respective ministries in capitals and are not the lead actors in STI policy co-ordination, as other consultation bodies are formally designated by law.

### *Co-financing and co-ordinating tools*

Nearly every responding country reported using a project co-financing tool to help align resources between national and regional governments. With one exception, all reported using a competitive project selection procedure for research projects, infrastructure and/or institutions. Competitive tender procedures are valuable for revealing information, thus reducing information asymmetries. However, in practice a bias nevertheless remains. There is a certain learning curve and capacity for applying to tenders. The experience of winning one tender makes it easier for the same applicants to do so in the future.

In only one-third of the countries using this tool was pre-selection by a sub-national entity typically required as a condition for the national competition. Such double selection may be time consuming and administratively complicated, but it has the advantage of confirming whether the national investment was a top priority for the region as well, and thus more likely to benefit from complementary actions to make the investment more productive.

The labelling effect of a competition has obvious advantages for aligning resources and helping to recognise regional assets. But when the competitions are too tightly defined, regions with atypical profiles or those with interesting experiments may not be able to access the resources needed. In around half of the reporting countries, sub-national entities may propose projects outside of nationwide calls for proposals.

Contracts across levels of government are used in varying forms for joint action in STI policy. A "transactional" contract approach requires the definition of a clear target for policy action as well as a known path to reach that target. Enforcement mechanisms are triggered when parties do not perform their agreed tasks. The problem in STI policy is that for some kinds of contracts, there is uncertainty initially (*ex ante*) with respect to the targets and the means of achieving them. Since innovation involves uncertainty, and it is not always easy to define strict output targets, experimentation and failures are part of the innovation process. That is why for some aspects of STI policy, a "relational" contract is more appropriate. This form involves joint decision making and adaptation during the contract period with a co-operative spirit, because all the information is not known beforehand (OECD, 2007b).

Many countries use contracts for regional development that involve STI spending. The French CPER (*Contrat de projet État-région*) offers a framework for long-term planning and co-financing of the region (including a number of investments related to STI) between several central level ministries and the region. In the 2000-2006 round of the CPER, areas covered included notably: *i)* the development of existing excellence poles; *ii)* continued deployment of research capacities in regions with strong university potential; and *iii)* preservation of the influence and international competiveness of large scientific centres. Support of STI assets is also part of Italy's central-regional contracts known as the *Accordi di Programma Quadro*. Sweden uses contracts for the Regional Growth Programmes.

There are examples of contracts for financing research and other STI policy instruments outside of regional development policies. Such contracts take many different forms. They may be used for policies, including working relationships or programmes to support national STI goals, as well as major investments (such as S&T infrastructure). Spain has increasingly used contracts (*convenios*) between the Spanish government and the autonomous communities (regions) in STI policy, in addition to other policy areas (see Box 3.5). In Austria, contracts (five years or more) for higher education institutions, research and innovation centres and other projects involve both federal and *Länder* governments. Similarly, in Germany there are long-term contracts for research (Higher Education Pact) and the Initiative for Excellence. In Sweden, long-term contracts are used for Vinn Excellence Centres. In Korea, the science parks and technology parks in regions have contracts with the respective ministry at national level.

### *Future trends*

Reporting countries identified expected future trends with respect to the regional role in STI policy. Trends identified generally imply either greater co-ordination across levels or greater reliance on regional efforts for national goals.

- **Improved co-ordination and alignment:** several countries reported an expected trend towards greater alignment but for different reasons: whether for budgetary reasons (Austria), in the context of upcoming plans or programmes (Netherlands, Peaks in the Delta), or through the creation of new entities (Poland, Council for Science and Innovation), to name a few examples.
- **Increasing role for regional level in meeting S&T and innovation goals:** Korea is looking to regions to support its 5+2 Great Sphere Economy strategy. Norway's recent approach of co-ownership for Innovation Norway is a sign of the increasing commitment to a greater regional role. This will likely also support greater alignment of spending across levels of government. Portugal anticipates progressive decentralisation of innovation support schemes for SMEs. Mexico's National Council for Science and Technology (CONACYT) is transferring the operation of instruments increasingly to states. Provinces in China are expected to make greater use of public procurement and targeting of emerging industries.

### Box 3.5. **Spain and STI policy: multiple contract approaches**

**Large S&T infrastructure:** the ALBA Synchrotron, a particle accelerator, is an important investment for both Spain and the region of Catalonia. Both layers of government have a low level of knowledge (relative to other types of agreements). Neither has previously built or managed such a facility. The structure of this agreement includes many of the characteristics of a "relational" contract, in which all the conditions cannot be specified in advance (*ex ante*), so the parties agree to follow the instructions of a common decision mechanism after signing the agreement (*ex post*). The joint financing (50/50), execution and management (*consorcio* including both levels) of the facility are important for relationship-building across levels of government as well as for deriving maximum benefit and limiting risks. Moreover, the project's success could have an impact on future R&D programmes carried out by the central government and by the other regions. Such programmes will depend on access to the equipment, as both partners will have to pay for maintenance in the future. The clustering of researchers around the Synchrotron will help the national scientific community in general by fostering the development of scientific programmes in related fields of knowledge, in addition to the region's own innovation system.

**Innovation co-operation at policy level:** contracts across levels of government can also be focused on relationship building, "agreeing to work together". Contracts are complemented by more concrete annual work plans. The Catalan Innovation Support Agency, ACC1Ó, and the Spanish CDTI (Centre for the Development of Industrial Technology) share common objectives for promoting innovation, spin-offs and knowledge transfer. Catalonia is the leading region in terms of CDTI funding receipt, so there are clear mutual interests in better collaboration. A 2005 *convenio* serves as a framework agreement to work together through a commission composed of actors on both sides to develop annual plans. In the first work plan, areas for collaboration included data exchange, personnel exchange, mutual recognition of project eligibility assessment, joint financing of projects and promotion of Catalan projects in EU programmes.

The Ministry of Science and Innovation has begun contracting with different regions to support national innovation policy approaches. The new E2I (*Estrategia Estatal de Innovación*) is modelled on a "pentagon of innovation" that covers finance, markets, internationalisation, people and territorial co-operation. The 2015 goals of the Spanish State for E2I consist of 500 000 jobs in medium and high technology, the incorporation of 40 000 additional innovation active companies, an additional EUR 1 billion a year in private investment, a return of 10% on European programmes, and a substantial improvement in the balance of technology products and services. The contracting region commits to its own quantitative objectives for meeting the plan's 2015 targets. The goal is to therefore "intensify co-ordination actions to support research, development and innovation in areas of common interest." Similar to other contracts, there is a joint Monitoring Commission with representatives from both levels. The funds are in the form of a loan to be reimbursed to the central government. The Basque Country is one of the first four regions to sign such E2I State-region contracts.

*Source:* OECD (2007), *Linking Regions and Central Governments: Contracts for Regional Development*, OECD Publishing, Paris, doi: 10.1787/9789264008755-en; OECD (2010), *OECD Reviews of Regional Innovation: Catalonia, Spain*, OECD Publishing, Paris, doi: 10.1787/9789264082052-en; OECD (2011), *OECD Reviews of Regional Innovation: Basque Country, Spain*, OECD Publishing, Paris.

## 3.3. Mobilising the right public and private stakeholders

### *Horizontal co-ordination tools for regional governments*

Vertical co-ordination mechanisms are more effective when there is an accompanying horizontal co-ordination as well. As noted in the challenges above, if co-operation across sectoral ministries and agencies involved in STI policy at the national level is lacking, it is even more difficult for regions to overcome some of their most pressing multi-level governance challenges. It also limits the regions' ability to take advantage of inter-sectoral complementarities. The same horizontal challenge is found at the regional level, where a similar sectoral logic is often applied.

As regions pursue an agenda for a broader approach to innovation, the range of sectoral departments relevant for horizontal collaboration has widened. The first attempts have been to bring together two policy areas often managed by different departments: *i)* the science, research and education agendas; and *ii)* the firm support/innovation agendas. This co-ordination is being pursued to offer a better continuum of policies and instruments. A next step has been to bring in departments that have research agendas, such as health, agriculture and transportation, into these inter-departmental efforts. An even more sophisticated approach has been to support the innovation agenda in a whole-of-government approach. The purpose of these broader agendas has been not only to address economic development of the region generally, but also to address the importance of innovation in public service delivery, as well as to mobilise innovation to address social challenges.

The strongest form of horizontal collaboration is to integrate several STI-policy functions under the same department. At national level, ministries have been merged in an attempt to internalise this co-ordination. Examples of this approach include Denmark (Ministry of Science, Technology and Innovation) and the United Kingdom (Department for Business, Innovation and Skills). A similar trend is being observed at regional level. Flanders (Belgium) has a Ministry for Economy, Entrepreneurship, Science, Innovation and Trade. The government of Catalonia (Spain) has also merged ministries to create the Department of Innovation, Universities and Enterprise. Policies for basic research, technology transfer and firm support are now are under the same departmental portfolio.

Committees and councils are more common co-ordination vehicles than mergers. At national level, many countries have tried to develop high-level STI policy councils following the acclaimed Finnish model (which is headed by the Prime Minister). But often such councils fall short of expectations. In Iceland, the Science and Technology Policy Council, though headed by the Prime Minister, does not possess the authority to force co-ordination between ministries that have a large degree of autonomy within their areas of competence. Korea's National Science and Technology Council is perhaps one exception, particularly since one of its tasks is addressing inter-ministerial rivalries to achieve greater policy coherence (OECD, 2009d).

At the regional level, such inter-departmental committees and councils are also being created. Catalonia's (Spain) Inter-ministerial Research and Technological Innovation Commission began in the 1980s, but was only recently able to play a truly inter-departmental role (OECD, 2010a).[8] Castile and Leon, via the 2001 Law for the Promotion and General Co-ordination of Scientific Research, Technological Development and Innovation, established two bodies. The Co-ordination Commission for Science and Technology includes representatives of all relevant regional government departments (8 of the 12). The Advisory Council of Science and Technology includes leading innovation system actors, both public and private, as a forum to work together in strategy design and development. Flanders has also made interesting efforts to develop more horizontally integrated policies across ministries (see Box 3.6).

### Box 3.6. **Flanders (Belgium): "horizontalisation" of innovation policy**

Flanders has for several years considered innovation a goal for policy across departments. The Ministry of Economy, Entrepreneurship, Science, Innovation and Trade gathers many of these functions. The approach to regional competitiveness is based on an innovation, as opposed to R&D, policy. High-level policy documents have also highlighted the cross-departmental approach:

- "The Flemish success in innovation is not only dependent on the policy domains in science and innovation. There is a need for an integrated horizontal policy involving the whole Flemish government, its ministries and agencies" (Policy Letter, Science and Innovation, 2005-2006).
- "The interactions between R&D, enterprise and international enterprise, with an eye on land planning aspects and knowledge intensity, imply that a fragmented policy approach is insufficient. These interactions can only be translated in an integrated policy approach, which endeavours to create as many synergies as possible between various policy domains."

The approach places emphasis on creativity, entrepreneurship and innovation, with an inclusive spirit that includes services and the public sector. Key priorities include: building a strong knowledge base in the public sector; valorisation of this base in outcomes relevant to societal needs; entrepreneurship promotion; creation of critical mass in technology and innovation; and rationalisation of public support and evaluation of public programmes and actions. In addition, the socio-economic development plan "Flanders in Action" (2006) placed as its top priority "creativity, innovation culture and entrepreneurship" with a recognition of open innovation and a focus on human resources.

The former Flemish Council for Science Policy (VRWB), created in 1985, has also been upgraded to support this approach. In 2007 it became the Strategic Advisory Council for Science and Innovation. The mission was changed to focus more on analysis and policy advice than *ex post* evaluation. Its mandate also involves taking a broader approach to innovation, as the mission includes consideration of "factors such as taxation, education, labour organisation in the enterprises, personnel management, social and political concertation procedures, government regulations, etc." (VRWB Advice 30).

*Source:* Cunningham, Paul (2008), "Monitoring and Analysis of Policies and Public Financing Instruments Conducive to Higher Levels of R&D Investments: The 'Policy Mix' Project: Thematic Report Governance", study funded by the European Commission-DG Research, March 2008.

A regional innovation agency (RIA) is a common option for the development and delivery of innovation policies at the regional level that can support horizontal collaboration (see Chapter 5). Some regional development agencies are either managed or financed by national governments, such as in Canada and Chile. They address innovation, as well as other issues, in an explicit multi-level governance approach (see above). Many agencies (such as IWT in Flanders or Scottish Enterprise) are created by the regions themselves to implement policies, or at a minimum deliver particular instruments. While some agencies have a more focused approach on instrument delivery, others are taking a more systemic approach that by definition promotes greater co-ordination and coherence across a policy mix.

### *Engaging firms and civil society in the policy process*

The concept of governance is not synonymous with government. Innovation policies are seeking to provide conditions that lead to innovations in firms. However, it is firms that ultimately need to take the decision to invest in innovation. Public investment is designed to leverage private sector investment, in the long term if not the short term. But how do policy makers ensure the appropriate private sector involvement to both "do the right things" and "do things right"?

"Doing the right things" can be reinforced by a well-informed innovation-driven regional development strategy. There has been a shift in many countries to encourage regional planning functions to go beyond land use and transport to include economic development that promotes innovation. Other regions already have more established systems for developing a strategy for regional development or even regional innovation specifically. Input from firms and other civil society actors is critical in these newer functions for regions. In a study of several European regions, it was found that when firms were actively involved in the region's "innovation journey", the region was better able to address problems as they arose or to increase the utilisation of policy instruments relevant for innovation (Benneworth, 2007).

The increasingly networked nature of innovation is another rationale to reinforce a more diverse group of stakeholders for strategy development. The private sector is generally more aware of the global trends and market conditions that will influence their innovation-related investments. Universities and research centres are more attune to the areas of promise for basic research breakthroughs. And for application of innovation to other areas of public service, civil society at large can play a lead advisory role.

Different institutional forms are used to solicit this private sector and civil society engagement. In some cases, regional development agencies or regional innovation agencies are by statute entities with a Board of Directors that includes public and private actors. The same is true of many regional advisory councils, such as the Science and Industry Councils in English regions or the Growth Fora in Danish regions (see Box 3.7).

#### Box 3.7. **Denmark's Regional Growth Fora: public-private advisory councils**

With the local government reform, regional growth fora were created to advise on regional growth initiatives. The growth fora bring together representatives of the business community, knowledge and educational establishments, the labour market parties as well as local and regional authorities. These are all actors with a first-hand knowledge of the challenges of the business community and the regional conditions for growth. They are responsible for:

- Advising on a regional business development strategy;
- Monitoring regional and local growth conditions;
- Recommending co-financing to the region; and
- Recommending structural assistance.

They also participate in the Danish Growth Council to ensure coherence between national and regional growth efforts.

*Source: http://www.deaca.dk/regionalpolicyactors.*

A common challenge, however, is to engage these non-public actors effectively. OECD reviews have found several barriers to their engagement. There are often a limited number of tireless regional champions who, through their dedication, persevere. However, getting fresh perspectives is often more difficult, as is involving SMEs who generally don't have the time availability to attend such meetings that can be somewhat bureaucratic or not always show immediate outcomes. Another difficulty observed is a lack of appropriate information to inform these committees for certain aspects of their strategic decision needs. This reflects in part of the lack of public sector capacity in areas that are newer for them, and for many innovation support is a new area. In France, the *pôles de compétitivité* had trouble incorporating universities in their governance structures. In other OECD regions, the universities were easy to engage in regular committee meetings but firms were harder to reach.

To support public action of "doing things right", private actors need to be more involved in the development of certain instruments. Frequent complaints for innovation support concern the administrative burden on firms for applying or the time delay for receipt of a response, funding or service. The lack of clear information on the public offer, especially in a multi-level governance context, is another common concern by firms. Evaluation and monitoring studies that measure the impact on agent behaviour (see next section) are another systematic way to get private feedback on publicly supported innovation support instruments.

There are risks associated with excessive private influence on regional strategies or policies, calling for balance in the mix of public and private actors and perspectives. Such a prescribed balance is common, with a quota by type of actor (firm, university, trade union, etc.). The goal is to ward off undue pressure or even capture of strategies or particular funding instruments. This risk is particularly present when an employer or sectoral specialisation is dominant in the region's economy. This bias is not only a problem for firms. In some regions, it is other actors such as universities that have had a dominant influence on strategy and public investment, orienting approaches too far from private sector needs.

### *Working across regional borders in support of regional goals*

Many regions are beginning to recognise the need to work beyond their regional boundaries for strengthening their own region's development. The recognition of the role of functional linkages that cross administrative boundaries is more developed in other policy fields, such as transportation and water management, than in STI policy. However, there are several rationales for regions to consider how to cultivate, or at a minimum not hold back, cross-regional development. Such rationales include:

- **Cross-border knowledge spillovers:** many innovation policy instruments are likely to generate spillover effects across regional boundaries. For example, the potential outreach of a large scientific installation is likely to extend much beyond the borders of the administrative region in which it is established. It is hardly possible, nor advisable, to restrict the diffusion of knowledge within borders defined from an administrative perspective. Cross-border spillovers thus create problems of appropriation when the investment is made by one regional authority only.
- **Economies of scale and indivisibilities:** the geographic size and financial resources of many regions does not allow for investment in a full innovation infrastructure matching all the needs of regional stakeholders. For example, innovation support services need a

critical mass of activities to reach a strong level of professionalisation, specialised venture funds can only work efficiently when there is a sufficient base of projects to spread risks, technoparks and similar real estate initiatives with a global outlook need to be branded at the level of larger territories for international visibility, etc.

- **International and global outreach of many innovation activities:** companies are extending their value chains and markets, and their recruitment areas, towards different types of regions. Headquarter functions, design and research may be located in one region, while production is located in another. Furthermore, there is no reason *a priori* why areas of economic or technology specialisation should necessarily correspond to administrative regions. The promotion of inter-company linkages and joint innovative ventures in the form of clusters or competitiveness poles, needs to take this openness into account.

One way to recognise cross-regional linkages and address the aforementioned rationales is in the design of the regional roadmap and smart mix of policy instruments (see Chapter 2). But there are different methods to support cross-border collaboration (see Table 3.8). Collaboration may take the form of projects, institutional relationships or strategic alliances. Different public or private actors may drive this process. Bottom-up initiatives occur when there is mutual recognition of the potential gains of co-operation. The problems of positive and negative spillovers (externalities) are, however, more difficult to measure in STI policy. Such cross-border collaboration can take many forms with respect to geographic scope (cross-border domestic, cross-border foreign and trans-national). What is most important is that the goals for such collaboration are clear so that the policy instrument or governance mechanism can act on them.

Table 3.8. **Regional cross-border collaboration: different approaches**

| Defining characteristics | Options |
|---|---|
| Footprint | -Cross-border, domestic<br>-Cross-border, international<br>-Trans-national, non-contiguous |
| Nature of collaboration | -Strategic<br>-Institutional<br>-Project (*ad hoc*) |
| Driving actor | -Regional government<br>-S&T institution<br>-Private sector<br>-Higher level government |
| Goals | -Functional area or other inter-dependency<br>-Common challenges and strengths<br>-Increase critical mass<br>-Increase specialisation and complementarity<br>-Economies of scale to joint action<br>-Overcome regulatory or institutional barriers<br>-Opportunities for knowledge sharing |

A number of common barriers to cross-regional collaboration need to be addressed. There are pressures on regional policy makers to ensure that benefits from investments are captured in the region. A greater understanding of the region's linkages and needs for development are helpful in this regard. Regional strategies can more explicitly recognise and promote some of these linkages. Instruments can be designed to promote, or not restrict, linkages outside the region (see Chapter 6). Incentives by higher level governments can encourage such collaboration. However, caution should be observed when promoting inter-regional collaboration simply for capturing funds.

National and supranational governments have been providing incentives for regional cross-border collaboration. These incentives tend to address problems of under-bounded region size, a lack of critical mass, or counter-productive regional competition. For example, in Mexico, the National Science and Technology Council launched a programme, FORDECYT, that provides funds to groupings of states that face a common thematic problem or a functional geographic need (OECD, 2009e). In Switzerland, the cantons have significant independent powers and compete amongst themselves, although the size of most cantons is not the appropriate spatial scale for certain policies. National funds have been established to provide incentives for inter-cantonal co-operation in STI (OECD, 2011b). The European INTERREG Programme, for example, has supported cross-regional STI activities in the context of other inter-regional co-operation initiatives. The European Research Area Initiative is also promoting greater inter-regional collaboration, often not in contiguous regions.

The motivations for regionally initiated collaborations are wide-ranging. For example, the three regions in the North of England have been working together to support a common innovation agenda within a jointly funded agency, the Northern Way. One aspect of the strategy is the N8 Research Partnership, designed to bring together different universities across the wider region around common relevant themes. The goals are to better mobilise assets towards common sectoral priorities and to build greater critical mass of research excellence to attract national funding (OECD, 2008). The ELAT triangle of regions in Belgium, Germany and the Netherlands have developed joint action and marketing for STI matters to strengthen their cross-border region’s knowledge assets. The Southern Technology Council in the United States groups 13 states, all seeking to promote innovation through information sharing, investment promotion and image/culture change.

## 3.4. New data and indicators, better monitoring and evaluation practices

As argued in the previous chapters, better data and indicators need to be developed. They allow for more objective and detailed understanding of regional innovation assets and constraints, as well as achievements of regional innovation policies. Multi-level governance arrangements should be informed by shared information on the position of regions within the national innovation landscape. This requires static and dynamic data, not only covering the classic variables of R&D investments or patenting. Additional relevant input data are needed, such as training for innovation and the innovation finance available, as well as innovation outputs, such as those from innovation surveys covering different forms of innovation (technological and non-technological), new firms created, and other such elements.

On the policy side, it is important to obtain a clear and evidence-based picture. Measuring the effective priority placed by regional governments on innovation, and between different innovation objectives, is not an easy task. Standardised and comparable indicators on government expenditures for innovation support are missing at the regional level, preventing such an objective analysis based on budgetary figures. Government budget appropriations or outlays for research and development (GBOARD) is one indicator for developing comparable benchmarks, as this is collected in a harmonised way in most countries, following *Frascati Manual* definitions. It could be broken out by federal/central and sub-national levels, as is already available in some countries, but this data is not yet collected by the OECD. However, given that R&D is only a subset of total public spending on STI policy, GBOARD would give only part of the picture.

Even if such indicators were available, they would remain insufficient to depict the orientation of regional innovation policies. In addition to total budgetary figures, a much finer disaggregation of budgetary data according to specific policy priorities would be required. Such an exercise has been carried out on an experimental basis in the Impactscan project in seven European regions, with the support of the European Union (Impactscan, 2007). In that analysis, participating regions seemed to mostly devote resources to the enhancement of innovative capacities in firms and to increase the availability of technologies. Fewer resources have been invested in other areas, such as support of co-operation arrangements, the creation of new high-tech based firms and internationalisation of local firms. Still, this approach shows a strongly high-tech bias, which cannot be the unique model for all regions in innovation policy support. To estimate the budget, participants needed to agree on the definition and content of policy objectives, and on the mechanisms to allocate specific actions under each objective. Despite the limitations of relative budgetary spending as a proxy for policy priorities, extending and standardising this type of metric to a larger number of regions would help compare and assess the relevance of policy orientations keeping in mind the diversity of regions. This is, for example, the approach being developed by the Regional Innovation Monitor project of the European Commission.[9]

Appropriate data and indicators need to feed advanced monitoring and evaluation practices. In STI policy, like regional development policy, several factors complicate the evaluation and monitoring processes. The combination of factors required varies by type of region. There is not a clear path to translate innovation "inputs" into economic growth, exacerbating the attribution problem frequently found in evaluation. And there is uncertainty with respect to the innovation process, as the next breakthrough innovation is not susceptible to planning. Furthermore, a long-term time horizon is required before certain policy initiatives can show economic benefits, which means indicators that address short-term outputs as well as longer term outcomes (results and impacts) are required. Such advanced data associated with adequate evaluation activities are still underdeveloped in sub-national STI policy, as few regions are equipped with sufficiently robust tools to examine whether their efforts are having an overall impact on regional performance, beyond a couple of basic indicators.

There is a cascading set of incentives between levels of government and public programme recipients in a multi-level governance setting. Regions are often closer to innovation system actors, but do not always have the infrastructure or practice of collecting information on the behaviour of programme recipients. One area often neglected in the development of these indicators is the perspective of the funding recipients, generally private actors. Higher levels of government also provide funds to support innovation system actors in a region, either directly or, increasingly, via delegation or transfer of that support to regions. Higher levels of government are therefore looking to give the right incentives to lower levels of government, which in turn need to give the right incentives to innovation system actors. Better tools for regions to track behaviour and programmes used by system actors are therefore vital before all levels of government can be effective in their respective roles. The development of common indicators and objectives not only reduces information asymmetries, but builds policy capacity and serves as an effective tool for alignment across levels of government to support policy coherence.

Most of the reporting countries to the OECD-GOV Survey indicated tracking very few, if any, STI-related indicators at sub-national level to support national level policy making. Countries that track such indicators began to do so in the 1990s or 2000s, for R&D expenditure and, in some cases, other human capital variables (such as R&D staff). Patenting was mentioned by only a couple of countries, and scientific publications by only one country. In some Asian countries, there has been a long-standing tradition of tracking S&T-related indicators. The Korea Institute for S&T Planning and Evaluation has been collecting indicators on R&D-related expenditures since the late 1960s to support budget planning and assessment of results. China also reports tracking key S&T indicators at sub-national level since the mid-1980s. While most countries reported using the indicators to inform policy generally, only in a couple of cases was financing reported to be based on the results. In addition to initiatives in the public sector, there are also academic institutions leading indicator development and analysis (see Box 3.8).

### Box 3.8. **Examples of STI indicator tracking for regions**

**France:** the EUROLIO Observatory (European Local Innovation Observatory) provides analysis and discussion on innovation issues at sub-national level. Their regional profiles and other reports are actively used by the French DATAR (Inter-ministerial Delegation for Regional Planning and Attractiveness).

**China:** in addition to regional (provincial) S&T *Statistical Yearbooks*, the China S&T Development Strategic Research Team produces an *Annual Report of Regional Innovation Capability of China* that assembles a large number of indicators relevant to STI analysis and comparisons of regional performance.

**EU Structural Funds:** Structural Funds spending is classified according to several categories, allowing analysis of the orientation of regional policies towards innovation, and cross-regional comparisons: *i)* research projects based in universities and research institutes; *ii)* innovation and technology transfer, establishment of networks and partnerships between businesses and/or research institutes; *iii)* STI infrastructure; and *iv)* training for researchers dedicated to research and innovation promotion.

Reporting countries indicate that at least some regions, if not most or all, collect, analyse and use STI-related indicators in their own policy making. While regions may be able to track some information themselves, in many cases the data has to be produced by a national statistical institute and made available at disaggregated levels. Large-scale innovation surveys to obtain micro-data from private actors may require efforts beyond regional means. The innovation practices of firms, as obtained through direct surveys such as the Community Innovation Survey, are not always constructed to derive results that can be disaggregated at regional level. In Mexico, where regional level data from national innovation surveys are not available, the state of Jalisco's S&T Council (COECYTJAL) commissioned its own surveys to inform the state's S&T policy. Regions are increasingly engaged in the development of their own innovation scoreboard indices.

Programme-specific indicators require an important infrastructure for collection by implementing agencies. In countries with less-developed monitoring systems, the indicators per programme tend to be audit-focused in terms of funds spent and recipients served. The ambition for indicator tracking also needs to be matched with resources. Catalonia (Spain) developed a list of 17 indicators for tracking the progress of its Research and Innovation Plan 2005-2008. However the second set of so-called reference indicators to monitor the outcome of policy actions included over 100 indicators, between 4 and 12 per support programme. As much of the information is held in the administering agencies, and not by the region's statistical agency, the committee charged with tracking plan follow-up could not monitor the full set of indicators anticipated.

## Conclusions

The combination of decentralisation, bottom-up regional initiative and increasing attention to place-based dimensions in national policy has resulted in greater areas of mutual dependence in STI policy. At the same time, it has created new challenges for each level of government. The OECD-GOV Survey (OECD, 2009a) provides additional evidence on the real role regions play in STI policy with respect to strategy and policy development, financing, implementation and evaluation. These different aspects of STI policy serve to clarify the relative importance of regions in terms of the actual level of decentralisation for STI policy (see Table 2.1). Nevertheless, information does not always readily exist in countries on which level of government is doing what, in terms of spending, or types of policy instruments. Such stocktaking informs current policy, supports evaluation, and clarifies the role regions can play in achieving national goals.

All levels of government, from supranational to local, are seeking to maximise the efficiency and effectiveness of their investments. Regions are struggling to combine financing from many different policy streams (sectoral and governance level) since they may rely on significant financing flows and policies from higher levels. National governments are seeking to reduce excessive duplication and competition among regions. In some cases, national governments are seeking to delegate more STI responsibility, but need assurances that regions have the capacity to use those funds effectively.

Understanding these most urgent challenges, and diagnosing their causes, is a prerequisite for identifying the right multi-level governance co-ordination tools. While there are many common challenges across OECD member countries, some are more critical than others in a particular country or region, whether they be related to policy silos, or lack of capacity, among other challenges. For example, if there is insufficient information at national level of regional assets, this may be less of a problem in a country where regions have a sufficient mandate and resources to develop those assets themselves, in contrast to a country where regions are not able to do so independently.

Some tools are more adapted to particular challenges. What is clear from the OECD-GOV Survey is that mechanisms for regular dialogue are generally considered among the most important tools in many country contexts. They can build relationships as well as promote information sharing, particularly about the most relevant regional assets that can be mobilised for improving not only regional, but also national performance.

Whole-of-government approaches promote innovation policy for a wider set of regional objectives. Public service innovation and innovation for social challenges are among the trends at national and supranational level for innovation policy. Some regions are also beginning to take this approach. Inter-departmental commissions and councils are common tools used for this broader approach to innovation. However, experience shows that they often fall short of expectations. Strong leadership is required to mobilise this wider set of public actors from different policy sectors.

Firms and people are the core of any innovation system. Mechanisms for public actors to engage with the private sector therefore require new ways of doing business. Regional innovation agencies are one governance tool; going beyond service delivery approaches (which in and of themselves are vital) but also serving a strategic role as an agent of change in regional innovation networks. This new logic of acting as a facilitator is a very different operating approach that may require capacity-building in the public sector.

## Notes

1. The regions of OECD member countries at this first tier vary considerably in terms of surface area, (from 100 km² to over 30 000 km²) and population (26 000 to 36 million), as well as economic output. This data refers to OECD regions as of 31 December 2009. Since that date, several countries have advanced in their accession process to the OECD.

2. Countries could report both short- and long-term changes, as the categories were not mutually exclusive.

3. As reported in Guellec and Wunsch-Vincent (2009), Sweden's package included 0.29% of 2008 GDP for science, R&D and innovation, Australia 0.25%, the United States 0.11%, and Portugal 0.13%.

4. Estimates provided directly by regions tend to be higher than the statistics reported by Spain, as evidenced in OECD (2010a, 2011a).

5. As many countries did not complete the local government column, these results are not reported directly due to uncertainty as to whether the omission was due to lack of local involvement or simply a non-response.

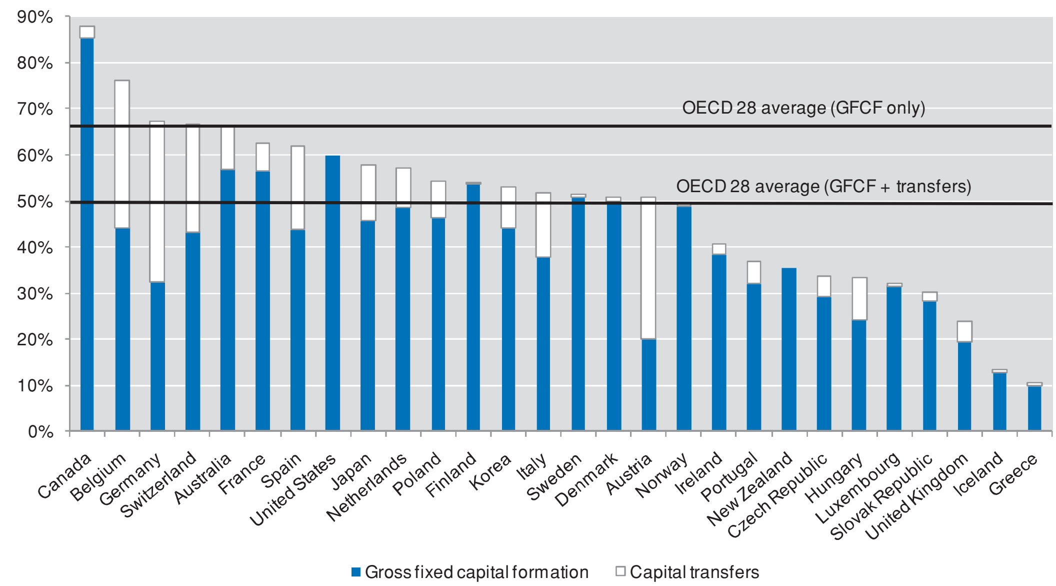
6. The data used for this analysis is the fourth wave of the Spanish Community Innovation Survey.

8. CIRIT was recently reorganised to become the CIRI, Inter-ministerial Research and Innovation Commission.

9. See *www.rim-europa.eu*. This project provides a database of indicators, policy profile and policy measures on innovation at the regional level in EU member countries.

# *Annex 3.A1*

Figure 3.A1.1. **Sub-national public investment as a share of general government public investment**




Note: 2008 or latest year available: 2007 for Australia, Canada, Japan, Korea and New Zealand. No data available for Chile, Mexico and Turkey. Data for Finland, New Zealand and the United States only refer to gross fixed capital formation.

*Source*: Calculations based on *OECD General Government Accounts*.

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# Part I

## *Chapter 4*

## Conclusions and policy advice

*Several key issues arise from the previous chapters that frame the role for regions and innovation policy. Among the most prominent are:* i) *the diversity of innovation strategies;* ii) *the fact that innovation goes beyond R&D;* iii) *the mismatch between functional regions and administrative borders; and* iv) *the generally shared governance for innovation policy across levels of government. Advice for policy makers encourages regions to be agents of change that develop a clear vision and strategic framework for innovation-driven regional development. To do so, regions should design a smart policy mix that builds on regional assets and brings together a portfolio from different policy areas. To implement this vision, more flexible governance mechanisms are required, supported by policy learning, better metrics and evidence-based experimentation.*

The current economic environment across the OECD has increased the pressure on all levels of government to pay special attention to policies for regional development, employment and growth. Innovation has become an important priority on national and sub-national policy agendas, and regions have emerged as key actors in this area. National innovation strategies increasingly incorporate a regional dimension. Regional strategic plans for innovation are being developed throughout OECD regions, with new instruments to encourage innovation being introduced. Regions can – and do – help to articulate a national vision for innovation, providing support for national development trajectories based on the exploitation of local assets. On the basis of the evidence from Chapter 1, the policy discussion in Chapter 2 and the multi-level governance considerations in Chapter 3, this concluding chapter highlights key issues and policy advice for innovation policy and OECD regions.

## 4.1. Key issues

### *A diversity of innovation strategies*

The diversity of regional potential for innovation is reflected in a wealth of innovation strategies across OECD regions. Regions are faced with different framework conditions; differences in endogenous assets; sectoral specialisation and human capital; various innovation bottlenecks; and diversity in internal and external connectivity.

The world of technology-based innovation is not flat. R&D and patenting activities are concentrated in a few regional hubs across the globe, including in fast-moving developing countries. Fewer than 13% of regions account for half of R&D expenditures in the OECD. Yet a wide variety of development paths exist not only within the small set of regions at the top of the innovation league but also in regions that are not competing within this top league.

The institutional framework for innovation policy is also extremely varied. In some cases, regions have the autonomy to develop their own policies, with the associated budgetary and regulatory means. More frequently, they simply implement national policies without a strategy tailored to their particular circumstances. The ambition and scope of innovation strategies will necessarily vary depending on these institutional differences.

### *Innovation encompasses more than research and development*

Regional innovation policies generally support national strategies intended to create first-class science and technology hubs. The location of such important national investments is a pressing concern, but at the same time, skills, resources and capabilities must be mobilised to ensure that innovation can drive regional development. Opportunities for types of innovation that are not based on R&D exist, but are governed by their internal dynamics and degree of connectivity to outside knowledge sources. A focus on R&D as a source of innovation should not pre-empt regional opportunities that can tap into other sources of innovation. Indeed, innovation activities can be undertaken by firms not intensively engaged in R&D.

Regional innovation policies tend to suffer from a narrow perspective. Science- and technology-based innovation covers only a fraction of innovation potential, and usually benefits from scale, agglomeration economies and network effects. Depending on a region's socio-economic profile and vocation, different forms of innovation may be more or less relevant. Some of these innovations are unfortunately not easily measured by standard indicators and are therefore not always considered. Such other forms of innovation can directly benefit a region's residents, such as the adoption and diffusion of regulations and zoning practices to promote community sustainability (e.g. construction codes to promote eco-friendly buildings or new forms of urban density and mobility).

While most OECD member countries have one or more R&D hubs, a key question is what to do in regions that do not have the scale or the conditions to develop a strong, internationally competitive science and technology focus. Regions typically have more competences in economic development and education than in science and R&D, and may more easily find their entry point into the innovation policy field in such arenas. In general, human capital is the primary factor in their development potential. Attracting, training and retaining workers is vital, as well as cultivating a range of skills to fit their innovation potential and build creative and entrepreneurial capacity.

### *Functional regions seldom match administrative borders*

Governments are accountable to those who elect them. They therefore favour policies that achieve outcomes in their own regions, defined by administrative or political borders. Innovation dynamics, however, are not typically contained within administrative borders. Many innovation networks extend beyond regional borders and are not amenable to policy interventions tailored to regional boundaries. This creates a potential mismatch, in which it is not easy to appropriate returns for investments within regional borders. However, policies are often confined to administrative spaces that are not necessarily suited to the functional relationships in the innovation process. This explains why it is usually necessary to manage the joint jurisdictional responsibility for policies affecting innovation capacity and outcomes, such as education and training, infrastructure development and S&T policies.

The cross-border dimension of functional innovation linkages remains poorly integrated into policies. This is yet another feature of this complex governance environment. The potential for cross-border innovation policies has not been fully exploited and thus constitutes a missed opportunity for OECD regions and countries. Benefits from cross-border areas emerge from: combining different endowments in the various regions and countries; exploiting the complementarity between various research traditions and knowledge bases; expanding innovation networks; using more diversified funding opportunities; and enhancing the visibility and appeal of the larger geographical area.

### *Shared governance in innovation policy*

Regions are not countries on a small scale. They do not exercise control over a complete innovation system or have a comprehensive institutional framework. Interdependence with higher levels of government is needed to carry out innovation strategies. Successfully situating the regional strategy in a broader national perspective is a key imperative for moving beyond the "one-size-fits-all" model and for defining policies that respond both to regional development targets and to national innovation and productivity goals.

The shared competences go beyond national and regional governments. Cities and other local authorities are also promoting certain instruments and fostering environmental conditions conducive to innovation. For some countries, supranational authorities such as the European Union play an important agenda-setting and financing role.

Complementarity and synergy between policies developed at the supranational, national, regional and local levels could be optimised through effective multi-level governance tools. Vertical interdependence across levels of government to achieve innovation policy outcomes is widely recognised. However, available evidence – including the OECD-GOV Survey (OECD, 2009a) – suggests that governance arrangements are not always specified clearly enough and thus require co-ordination tools to be more effective.

The task for regional policy makers is to define the relevant space for their action. Strategies and instruments need to take into account the spatial dimension of different innovation processes. They also must be implemented in a multi-level governance framework, with the other levels of government operating in the region as well as with relevant peer governments in other regions with functional ties.

## 4.2. Policy advice

### *Make regions agents of change*

Regions support innovation to boost growth and improve quality of life. In addition, they can represent relevant sources of ideas for developing national growth strategies. Experimentation in policy and governance at the regional level can advance regional and national development goals. The increased relevance of innovation "for" and "in" regions requires a holistic focus. A vision for a region's well-being is best grounded in a keen appreciation of its strengths and weaknesses.

Innovation support is relevant for all regions, but an appropriate policy mix must be formulated. The questions are how to set priorities amongst possible avenues of innovation promotion, and how to design policies and implement an appropriate mix of instruments corresponding to defined priorities.

The notion that governmental intervention might be sufficient to replicate the success of such regions as the Silicon Valley has gained traction. However, analysis of both more and less successful cases of policy intervention shows that this has not generally been the case in OECD regions. Policy intervention alone cannot achieve results without strong innovation efforts from business, the driving force for innovative clusters.

So what can regions do? Supporting new entrepreneurs is one approach to changing regional development paths locked into trajectories of the past. Encouraging connections between knowledge providers and local businesses is another response, taking the form of diffusion mechanisms or the establishment of public-private partnerships around innovation. Regions can create spaces that favour the interaction among firms within and across sectors, as well as raise the density and quality of services offered to businesses. They can foster outward linkages for regions poorly connected to global networks.

Regions are, or can be, agents of change. Regional governments play a key role in recognising opportunities for change, mobilising resources towards diversification and identifying new frontiers. However, this search for new regional advantages needs to be part of a broader national strategy and will require input and collaboration from the community at large. Regions can transform themselves by what some have termed "constructing their regional advantages", based on a clear appraisal of their existing asset base and attraction of new talent and businesses. The focus of regional innovation policies should hence be on encouraging openness to change by agents in the system in place. Business support instruments should prioritise the development of human capital and learning processes, thereby cultivating behavioural change in people and firms.

To implement this role of change agent, regions need to:

- develop a vision and strategic framework to encourage innovation;
- design an asset-based and multi-sectoral mix of policies;
- establish multi-level, open and networked governance structures; and
- foster policy learning through better metrics, evaluation and experimentation.

### *Develop a vision and strategic framework to encourage innovation*

There is clear evidence that innovation generation is neither linear nor predetermined, but shaped by a high degree of uncertainty, including human genius as well as plain luck. The relationship between uncertainty and innovation is a factor of dynamic change. Supporting that change in an uncertain environment represents a challenge for implementing innovation policy. This challenge is even greater for regional governments because regions do not control the entire policy toolkit required to develop, implement and measure the success of comprehensive innovation strategies.

Managing dynamic change demands a shift toward outcome-driven policies based on a strategy for innovation-driven regional growth. The first step is a clarification of the broad objectives to be achieved under an overarching vision, along with their translation into measurable goals. Situating the innovation agenda in a regional development strategy calls for an answer to the question: innovating for what and how? A comprehensive vision for the region's development should be the basis for defining strategic, as well as operational, objectives.

Defining effective innovation policies for regions requires a multi-dimensional perspective. Each region has some degree of freedom to define its development strategy, elaborate policies and allocate resources. An innovation strategy is oriented toward change; therefore regions in similar circumstances can adopt different forward-looking strategies. Thus, a strategic framework for innovation in regions should be predicated on a clear understanding of the region's profile.

The strategic dimensions of an innovation policy framework for regions may take several directions. They include: *i*) identifying and building on the region's existing asset base and its current advantages (science push, technology-led or a mix); *ii*) supporting socio-economic transformation (reconversion or seeking new specialisations, training, attracting and retaining human capital); and *iii*) catching up (through the creation of knowledge-based capability, upgrading or expanding strategic infrastructure in the region). These different choices introduce variation in regional innovation policies even across regions that present similar economic, innovation and institutional profiles. These choices require articulation with national goals and policies. And conversely, national and supranational policies need to take the regional realities into account.

Private-sector input into innovation strategy development and implementation is critical. Governance arrangements should allow for ongoing feedback into innovation policy and programming development from non-governmental actors, including SMEs, scientists, academics, training institutions, labour groups and other players essential to the effective and efficient implementation of innovation strategy. A healthy public-private dialogue is cultivated by credible and high-level leadership and long-term political commitment to the vision for the region.

As agents of change, regions need to develop a strategy that is flexible and constantly adapted to new challenges or opportunities. Indeed a policy outcome is not static. Building capacity to manage change is crucial to ensure that the region's strategic innovation policy objectives can be met. Yet effective regional strategies also rely on a certain degree of institutional continuity as a signal of policy commitment, given the long timeframe needed for many investments to pay off. The contribution of regions and their innovation policies to the national innovation and economic-growth agenda should be a critical component of the strategy.

### *Design an asset-based and multi-sectoral mix of policies*

A second step is to assess existing, and craft new, policy instruments to achieve the overarching regional vision and the policy outcomes defined to implement it. Performance measurement criteria need to be incorporated in their design. A synergistic approach – crafting an asset-based policy mix designed to pursue the region's innovation strategy – reduces the risk of conflicting policy impacts on the region's innovation potential and its growth. It also calls for the integration of policy instruments from various policy fields (environment, education, etc.), including the use of regulations.

Several regions have accumulated extensive experience in designing and managing advanced innovation policy instruments. However, modifications and improvements to instruments are too often made on an incremental basis, such as adjusting the funding target criteria or programming conditionality, without due consideration to the overall effectiveness of the policy portfolio. Experience within the OECD in designing and implementing such policy instruments reveals a proliferation of instruments and institutions and a high degree of fragmentation. Regional actors are confronted with innovation promotion mechanisms, support instruments, rules and organisations that have accumulated over time by successive governments at several levels. A comprehensive understanding of the linkages, synergies and interdependencies across instruments is often lacking. Fine-tuning existing policy and programming instruments is not enough.

Bundling different instruments into a coherent initiative is the new trend. This approach internalises the potential policy conflict across different sectoral policies. For example, policy packages to support high-tech start-up firms could combine physical facilities, financial support, mentoring and coaching services, training, services for intellectual property management, access to research facilities, and linkages to technology platforms or networks.

Ultimately, designing a policy mix includes multiple considerations, such as: synergy between instruments from various levels of government; regionally adapted balance among instruments that target knowledge creation, diffusion and exploitation; a combination of traditional instruments and recently introduced or experimental instruments; and integration of instruments from several policy fields chosen on the basis of their effectiveness, both individually and jointly.

### *Establish multi-level, open and networked governance structures*

Efficient policies for innovation in regions call for greater vertical and horizontal coherence in policy development and programme delivery. Greater co-ordination is required for better innovation outcomes for the region and the country. Complementarities of policies and instruments need to be developed vertically (across governments at various levels) and horizontally (between policy areas and programmes from within a single government), and fine-tuned to functional regions (cross-border policies) for greatest impact.

The difficulty of vertical co-ordination stems from the fact that each level of government has different types of information, resources and capacities. OECD member countries report that they use many co-ordination mechanisms for innovation policy at the same time (dialogue, consultation, contracts, project co-financing, regional development agencies, territorial representatives). One lesson that emerges most clearly from country feedback is that regular dialogue and consultation are generally considered to be the most effective tools for co-ordination in a multi-level governance context. Dialogue can build relationships as well as promote information sharing. It can shed light on the most relevant regional actors in the private and academic sectors, as well as in governments, that can be mobilised for improving not only regional, but national performance.

However, the range of governance and fiscal instruments at the region's disposal varies greatly. Therefore, it is important to remain flexible when establishing multi-level governance tools. While in some countries sub-national spending for certain aspects of STI spending exceeds 50%, nevertheless a significant share of public resources available to the regions flow from national and supranational levels. Per the OECD-GOV Survey, regions actively use many innovation instruments that are also used at the national level. Hence, synergies and complementarities should be achieved using programming instruments from various levels of government and different policy fields.

A common trap in regional innovation policies is an excessive focus on actions targeted to innovation processes that have a local dimension. The limits of this approach are well known. It is difficult to define *a priori* the local dimension of most innovative activity. Firm co-operation in innovation, and S&T networks, extend well beyond regional or even national borders. Even in the largest OECD regions, it is highly unlikely that innovation drivers, barriers and opportunities can be encompassed within regional administrative boundaries. The globalisation of economic activity, the need to connect to wider knowledge networks and the internationalisation imperative of companies are generally recognised in regional strategy documents. In addition, the benefits from public investment for innovation leak across regional boundaries. However, regional innovation policies mostly deploy their tools in the restricted space of administrative regions, rather than across functional regions. Policies are implemented "in" regions rather than "for" regions. The answer is to adapt policies to functional regions, beyond administrative borders.

Regions may compete in productive as well as unproductive ways. The development by regions of competitive advantages in the innovation system can lead to a virtuous cycle. Regions increasingly specialised in more value-added intensive activities may complement one another across production and distribution processes, benefiting not only the regional economy but that of the country or transnational region as a whole. But competition on the basis of short-term imperatives (e.g. to attract mobile investment) can lead to a perverse situation negatively affecting both regional and national development. Open, networked multi-level governance approaches should support the building of inter-regional complementarities.

### *Foster policy learning through better metrics, evaluation and experimentation*

Policy evolves incrementally and it advances through trial and error. The newly prominent role of regions in innovation requires not only the availability of resources to pursue innovation policies, but also the capacity to design and implement them. Strategic intelligence is a necessary condition for policies to effectively contribute to their defined outcomes. Required information includes systems analysis, benchmarking, performance evaluation, visioning and strategic learning platforms. Time, resources and space are also needed for regional policy learning. Each region could benefit from cross-regional benchmarking initiatives that afford an opportunity to profit from potential synergies and identify good practices that work elsewhere.

Policy experimentation implies a certain tolerance for failure. Regions can be excellent laboratories, and policy makers need to be given space to learn from mistakes. But pragmatic experimentation needs to be backed by outcome-oriented policy evaluation. Regional innovation monitoring exercises and access to information on regional innovation need to be supported. This requires adequate internal resources (administrative capacity, human resources, political commitment) and external connections to national and international policy learning networks.

Policy circles should help develop so-called “unlearning” capabilities. Regions need the capacity to change by abandoning routines from the past and adopting new practices and models. Regions can be policy laboratories for small-scale experiments, but such experimentation needs to be accompanied by systematic assessment and follow-up. Feasibility studies, demonstration and assessment of the impact of new policies or policy mixes can then be made available for adoption by other regions or by higher levels of government.

Policy makers are accountable for the impact of their policies on the well-being of the residents they represent. In contrast, traditional evaluations in the STI field measure the level of outputs (such as new R&D investments, patents and publications), rather than outcomes. Measuring the impact of a change in behaviour (in terms of new innovation culture, new collaboration patterns, change in firm organisation for innovation, etc.) is relevant for measuring the additionality of public action on innovation policy goals. The evaluation process also needs to pay more attention to the effectiveness of policies if the goal is to improve strategic learning for policy makers and agencies.

These considerations call for sound metrics and benchmark indicators to provide policy makers and the public with the empirical evidence on innovation policy outcomes. A narrow view of innovation is reinforced by this lack of metrics. The OECD Innovation Strategy stressed the need to improve the quality of existing metrics and increase the availability of indicators to measure innovation factors that are either not at present measured or whose strategic importance has been underestimated (especially investments in intangibles). New data, indicators and models for the regional level are needed, in particular for R&D- and non-R&D-based innovation, mapping of innovation networks, and the dynamics of regional policy efforts.

The main difficulty in linking policies to outcomes is the capacity to assess the impact of the mix of policies on regional performance. There is a need to measure the joint contribution of various instruments acting together in synergy and in a complementary way. When policies are designed in silos and delivered in a fragmented fashion, particularly if they are delivered by a multiplicity of agents, achieving such joint effects is very difficult. Robust and widespread monitoring and evaluation practices are called for, going beyond mere administrative and use-of-funds audits. Outcome-oriented evaluations require systemic approaches. Individual instruments need to be assessed against their own sectoral objectives as well as their impact when combined with other tools.

## 4.3. Summing up

Throughout this report, many facts and arguments call for a networked view of innovation. Such a view takes into account the role of intra-regional nodes in wider inter-regional networks, including cross-border innovation spillovers. How to mobilise different actors and resources, both within and outside the region, to engage in innovation ventures should become a key governance concern for policy makers focusing on innovation policy.

Finding and building on a region’s unique assets for strategic development goals is the task for policy. To this end, regions need to develop a sound, realistic vision of their economic future and formulate a broader, more integrated, more efficient policy mix. It will require combining instruments from various policy areas and levels of government, supporting knowledge generation, diffusion and exploitation, into coherent policy packages. Finally, regional innovation capacity needs to be built in a way that establishes complementarity with innovation strengths in neighbouring regions. Sound innovation policy is not only about creating innovation; it is about creating the conditions that enable innovation and its benefits to materialise in the form of improved economic, social and environmental outcomes for society as a whole.

# Part II

# Agencies, instruments and country information

# Part II

## *Chapter 5*

## Maximising the impact of regional innovation agencies

*Regional innovation agencies are established across the OECD to deliver innovation policies at sub-national level. Various agency models are possible. This chapter illustrates the diversity of models in practice, highlights success conditions to achieve a new paradigm for innovation and regions, and discusses the key strategic challenges agencies face. Their primary challenge is to serve as change agents for the regional innovation system. They need to focus on absorptive capacities and learning processes, both for their policy targets and management of the agency itself.*

## Introduction[1]

Many options are possible for delivering innovation policies at the regional level. Establishing regional agencies is one option that grants regions more responsibilities than a fully centralised model. But the agency model is not uniform, as a diversity of models co-exist in practice. There is no one best-practice model, rather experimentation is the rule.

Little is known about the effectiveness of the various agency models. Sophisticated empirical analyses have been used to assess and compare the impacts of more established policy instruments, such as R&D tax incentives or subsidies. However, evaluations of the impact of regional innovation policy as a whole, or of regional innovation agencies (RIA), are rare. At best, evaluations are performed for programmes and then used as a weak proxy for an agency's effectiveness. This dearth of evaluation is a serious concern, as policy makers increasingly face the need to justify their actions to constituencies.

The principal-agent problem is at the core of this chapter: how can policy makers assess and improve the effectiveness of regional innovation agencies? In line with New Public Management practices, the separation of the policy-making and policy implementation functions is becoming more widespread, leading to "agencification". Agencies are set up to fulfil the implementation function. They have greater proximity to, and thus information about, beneficiaries that can be used to inform policy.

The definition of a RIA is based on four criteria (see Box 5.1). This definition allows for a wide variety of agency models, as found in practice. Despite the absence of reference models and empirical analyses, this chapter draws lessons based on a conceptual analysis using existing examples and experiences. It offers good governance considerations for different models, rather than a prescription for one ideal model.

### Box 5.1. Definition of a regional innovation agency (RIA)

An organisation qualifies as a regional innovation agency for the purposes of this analysis if it fulfils the following four criteria:

1. **public mission:** the organisation's mission is complementary to private services, responding to market or systems failures;
2. **geographically bounded at sub-national level:** the organisation's mission targets a given region, defined along administrative boundaries;
3. **permanent:** these organisations are not projects but structures with an indefinite lifetime; and
4. **promotes innovation in a broad sense:** supporting innovation activities in the region is one of the goals, or the only goal, of the structure. The mission encompasses a wide range of innovation aspects, and not just a single instrument or target group.

This chapter first defines a conceptual background for the analysis of RIAs using elements from the theoretical and policy literature (section 5.1). Section 5.2 reviews the diversity of RIA models in practice given the principles set for analysis. Four case studies are used to identify the key dimensions around which RIAs may differ. By confronting these actual models with the principles, section 5.3 highlights the advantages and drawbacks of various models for the effectiveness of regional innovation policies. The concluding section provides policy recommendations for governments considering the use of RIAs for the implementation of regional innovation policies.

## 5.1. Role for RIAs in the new framework for regional innovation

The new views on innovation and innovation policy, which have been discussed in prior chapters, have important consequences for the role of regional agencies in charge of promoting innovation. Modern RIAs should display a number of characteristics (Table 5.1).

Table 5.1. **The new context for RIAs**

| Issue | Old paradigm | New paradigm |
|---|---|---|
| | **Agencies as part of the system** | |
| Place of agency | Outside of the system | Actor in the system |
| Role of agency | Top-down resources provider | Facilitator, a node in the system, change agent |
| Rationale for intervention | Market failures | Systems failures, learning failures |
| | **Enterprise-centred innovation system** | |
| Innovation definition | Innovation as exploitation of technological opportunities | Wider concept of innovation, market opportunities as key driving force |
| Target of instruments | Technology transfer | Firm absorptive capacities<br>Learning capability<br>People, talent, competence, creativity |
| Learning channels for innovation | Research providers, industry-science relationships | Firm-to-firm interactions, firm networks, public-private partnerships;<br>Importance of innovation environment |
| | **An open territory** | |
| Territory definition | Administrative boundaries<br>Local networks focus | Functional definition, cross-border regions<br>A node in global networks |
| | **Constructing regional advantages** | |
| Mission | Redistributing funds | Identifying and reinforcing strengths in the system<br>A change agent |
| | **Smart policy mixes** | |
| Instruments | Isolated instruments | Portfolio of interacting and co-ordinated instruments ("smart policy mix") |
| | **Policy co-ordination** | |
| Organisation of intervention | Fragmented intervention landscape | Policy co-ordination – by fields and levels |
| | **Strategic intelligence** | |
| Goal definition | Based on existing structures<br>Static | Problem-oriented<br>Agile |
| Accountability and monitoring mechanisms | Administrative and financial | Strategic, goal-oriented |
| Evaluation focus | Input and output additionality | Behavioural additionality and learning capacity<br>Evaluation as learning device<br>Focus on effectiveness |
| Management style | Traditional | Oriented towards learning |
| Autonomy | Restricted: executive mission for authorities | Expanded: delegation of strategic decisions |

*Source:* Nauwelaers, C. (2009), "Governance of Regional Innovation Policy: Variety, Role and Impact of Regional Agencies Addressing Innovation (RIAs)", background paper for OECD.

### *A focus on enterprises and people as key engines of innovation*

At the core of the system, key actors for innovation are firms, and as such they constitute the target group for agencies. This approach leads to a change of perspective compared to the linear innovation approach which focuses on technology transfer channels and institutions. Enhancing firm absorptive capacities and learning abilities is seen as a core determinant of innovation performance at firm level. People, skills and learning become the key ingredients of innovative capability. Creativity at individual and company level is also at the core of system performance. The capacity of people and organisations to use, transform, adapt and create value from technology acquires a central role in innovation (systems) performance. Tacit skills and learning-by-doing processes are thus as important for innovation as access to codified information. In this expanded view of innovation, seen as commercial exploitation of new ideas, the notion of innovation is wider than technological innovation. RIA missions and actions should be defined and evaluated using this firm and people focus, including a broad view on innovation.

### *An "open" territory definition*

A regional innovation agency, by definition, focuses on a particular region's needs. But such a focus should not lead to a closed, inward-looking view of the regional innovation system. On the contrary, the role of the agency should be to connect local actors to global value chains and innovation sources. This approach stands in contrast with a localised systems view in which the agency's intervention area is confined to the administrative boundaries of the region.

### *A mission focused on "constructing regional advantages"*

The focus of an agency's mission is to enable strong assets of the targeted areas to contribute to its economic development. Identifying lock-in threats and favouring diversity and evolution of the area become the agency's core mission. Creating viable growth poles from scratch has proven difficult to achieve in OECD regions; but capitalising on existing strengths is a viable option. While every piece of codified and free information becomes available worldwide instantly through the Internet, what matters primarily is the capacity of agents to access, sort, absorb and use this overflow of information for innovation purposes. Effectively transforming this information demands enhanced absorptive capacities and strategic intelligence tools. Such capacities can be fostered by exploiting the advantages of proximity to exchange and foster tacit knowledge. These new regional advantages therefore need to be "constructed", based on the development of existing strengths. In this context, regional agencies should act as change agents in the system.

### *Use of a smart mix of instruments*

As innovation is a complex and multi-faceted process, it can be supported along many dimensions. Accessing a multiplicity of uncoordinated instruments is time-consuming for firms and runs the risk of duplication or negative interactions. Establishing a balanced mix of instruments to cover all system functions is a necessary condition, but the recipe for this mix is not straightforward. The mix depends on the goals to be achieved and the specificities of the target groups and their environment. The challenge for agencies is to identify and manage such an appropriate mix given the regional specificity.

### *System facilitator based on a systems failure rationale*

Along with classical market failure arguments, the "systemic failure" rationale is gaining support as a justification for innovation policy. The systems failure approach gives way to a broader range of intervention areas than the traditional instruments of R&D subsidy and tax incentives or funding of public research organisations. The objective of policy intervention moves from addressing a less-than-optimal allocation of resources towards ensuring the overall coherence of the system and improving its evolution capacity. Consequently, "systemic" policy instruments are also gaining ground. Such instruments are oriented towards the evolution of the innovation system, preventing lock-in, and favouring the building of spaces for interactions among system actors. Policies in support of creativity are also increasingly important.

The main role for RIAs is to foster the smooth functioning of the targeted innovation system and to eliminate barriers to flows in the system. This facilitator role stands in contrast with a traditional role of a top-down supplier of resources based on market failure arguments. To improve system functioning, a RIA needs to target not only traditional system actors but also informal institutions which play a role in innovation potential and performance, addressing notably cultural barriers to innovation.

### *Well-co-ordinated policies (horizontally, vertically)*

Ensuring synergies among policy instruments demands a high degree of policy co-ordination. Instruments from various origins and intervention fields need to be co-ordinated and aligned towards well-identified goals. RIAs can internalise several instruments within a broad, multi-purpose agency. In that case, the challenge is to ensure internal synergies towards generic goals, to which the various parts of the organisation should contribute. These actions can also be externalised. In this case, the challenge is to ensure an efficient network of agencies, intermediaries and service providers. Both the networked and the single agency model need to co-ordinate policy intervention across fields of intervention (research, technology, training, etc.) as well as levels of intervention (local, regional, national, and supranational).

### *Use of strategic intelligence tools*

Defining a smart policy mix which responds to the identified challenges and structure of the innovation "ecosystem" requires strategic intelligence capacities. They are needed at all phases of the policy cycle: from policy design to implementation and evaluation. Such strategic intelligence needs to be supported by sound and robust analytical tools, and monitoring and evaluation practices which are well embedded into the policy cycle. Accountability systems for agencies should be goal-oriented assessments rather than mere administrative and financial conformity checks. Both effectiveness and efficiency of an agency's actions should be given prime attention. Additionality considerations should be part of the agency's mission as well as evaluations of its actions. The agency should also be able to renew itself according to identified performance gaps and successes, which requires internal agility. Evaluations need to serve learning purposes, and not (only) be used for monitoring and sanction. For agencies to be able to play a strategic role, they need to be granted a sufficient degree of autonomy. In other words, agencies should themselves become learning organisations.

## 5.2. RIAs in practice

There are important differences between RIAs as they appear across OECD member countries. The United States and EU approaches towards regional innovation policy differ, and so does the concept of an agency in this context. A main difference is that in the United States, there is no tradition of co-ordinated regional policy or regional innovation policy at federal level. At sub-national level, many of the initiatives for supporting innovation are *ad hoc*, based on a variety of partnerships actively involving private sector organisations, and generally with more limited involvement of regional authorities relative to European counterparts. Economic development agencies do exist in many states and their work involves support for innovation or technology-based development. Sub-national partnerships are of variable geometry. The nature of their actions varies across territories and the definition of targeted regions is in some cases more flexible (cross-state partnerships exist).

In the European Union, the role of regions in national innovation policy is becoming more explicit. Regional authorities increasingly take a pro-active role in promoting innovation. Many European regions have established regional innovation strategies. Their support system is institutionalised and subject to government intervention. These strategies are often placed within broader economic development goals, and managed by regional agencies. As a result, regions in several EU member countries are operating with an increasing degree of autonomy to develop their own policies, most often in partnership with national authorities (see Chapters 2 and 3). The same trend can be observed outside of Europe, with highly centralised countries like Chile increasingly recognising the importance of this regional dimension.

Two sets of characteristics can be used as a frame against which to analyse agencies:

- **Descriptive characteristics** of their operation (see Box 5.2). The definition of eight key dimensions for these characteristics is derived from information available from the agencies directly as well as from academic and consultant analyses. The list is not exhaustive but represents the core dimensions of the agency model and reflects the diversity of regional contexts and policy options.

- **Analytical characteristics** derived from the conceptual analysis above (see Table 5.1). It proposes normative dimensions for RIAs. It is expected that a hypothetical agency working under the new paradigm would conform to most of these dimensions. With the exception of characteristic six (degree of professionalisation of services), for which a high degree is expected if an agency conforms to the new paradigm, there is no *a priori* link between the descriptive and analytic characteristics.

Four agencies have been selected to represent a diversity of models according to the above dimensions characterising RIAs. Analyses of RIA impact are rare. And many RIAs operate without a clear mission or results-oriented vision. The selected RIAs are among those rare cases where at least partial evaluations of the agency's work and impact on economic development and innovation are available. The selected case studies include the following RIAs (see Tables 5.A1.1 and 5.A1.2 for a summary of each agency's descriptive characteristics and analytical characteristics, respectively):

- Industrial development centres (IDC), Sweden;
- Scottish Enterprise, United Kingdom;
- IWT, Institute for the Promotion of Innovation by Science and Technology in Flanders, Belgium; and
- Regional development companies (ROM), the Netherlands.

### Box 5.2. **Descriptive characteristics of RIAs**

1. **Size:** from a few employees and EUR 200 000 turnover in some new EU member countries to 200+ employees and EUR 500 000 in very large Regional Development Agencies (RDAs) (e.g. Advantage West Midlands, United Kingdom).
2. **Scope of intervention:** from a small agency with a role limited to the co-ordination of other intermediaries and service providers, to a large agency providing a wide range of in-house services including funding, infrastructure provision and soft services.
3. **Target of intervention:** differing priority between target groups: start-ups, foreign investors, domestic firms, SMEs, etc.
4. Degree of **vertical integration and extent of regional networking** with other agencies: one agency among others or a central node in the system.
5. **Funding model:** a large variety exists in the share of own resources from service provision, the share of public support and the composition of this support between local, regional, national, and in some cases supranational (EU) sources. In poorer regions of EU countries, EU Structural Funds may represent a very large share of funding. The share of structural versus project funding also varies a lot according to the service portfolio.
6. **Degree of professionalisation** of services: use of formal diagnosis tools (audits, etc.) and evaluations.
7. Degree of **linkage with regional development policy:** from a central instrument for this policy versus an agency with weak linkages to explicit regional policies.
8. **Sector focus:** the most widespread model is mainly generic (covering all economic activities and sectors) but some large agencies work along priority areas and provide specialised activities and staff for each area (such as Scottish Enterprise). Recent initiatives represent atypical cases focused on one sector of activity (life sciences and biotech, such as the Danish-Swedish Medicon Valley Alliance, or the French-German-Swiss Biovalley).

Among the case study examples, the RIAs are agents of the national government, agents of the region only or a hybrid. The Swedish industrial development centres are networks of bottom-up and regionally distributed business development and innovation agencies gathered under one programme supported by both national government and regional authorities. The Dutch regional development companies are arms of the national government for regional development, a mission which includes innovation promotion. The Flemish IWT and Scottish Enterprise are genuinely regional initiatives, the former focusing on R&D and innovation, the latter with a broader remit. The examples from Scotland and Flanders also come from a more decentralised governance context.

The analysis shows that the case study agencies in general seem to evolve, at least partly, towards the new paradigm for regional innovation policy. In particular, they view innovation as a multi-faceted phenomenon, act as nodes or facilitators in the innovation system, and seek to provide a smart policy mix of instruments to foster change or construct regional advantages. However, this new approach demands co-ordination and strategic capabilities and tools, which few agencies seem to have developed at a sufficient scale.

Those agencies with a broader regional development remit, (such as Swedish IDCs and the Dutch ROM), address innovation from a wide perspective. They provide services covering various facets of innovation policy. However, the former seems less well positioned as a change agent than the latter, since ROMs have a more explicit focus on priority and future-oriented sectors. IWT is the agency with the most focused mission of the four agencies, with a remit on R&D and technological innovation. Nevertheless, it is in the process of extending its activities to a wider definition of innovation. Its core mission is complemented by a strategic networking and co-ordination function with other intermediaries that provide specialised and soft support to companies.

Most of the agencies interact with other system agents in a networking role. Even the largest agency with a one-stop-shop model, Scottish Enterprise, is evolving and downsizing towards a more decentralised model. The tension between large agency size and the necessary agility to act in an evolving regional innovation system is at the core of such agency changes.

## 5.3. Key strategic questions for RIAs

Several strategic questions emerge from analysis of the case study examples (see Tables 5.A1.1 and 5.A1.2). Together, these questions provide an agenda for enhancing RIA impact:

- How can RIA effectiveness be assessed?
- Which model should an RIA choose: the networked or the centralised model?
- Which missions should be given to an RIA: a broader development mission or a more focused innovation promotion mandate?
- Should RIA management privilege stability or experimentation?
- What is the most effective RIA funding model?
- What is the relevant territory for RIA action?
- How should an RIA define a suitable menu of services and activities?

### *Assessing agency effectiveness*

Traditionally, evaluations have focused more on efficiency (are agencies doing things right?) rather than on the more difficult question of effectiveness (are agencies doing the right things?). Both are needed, but agency effectiveness is even more critical within a strategic context. There is no definitive answer as to the right method for assessing an agency's effectiveness. There are several problems associated with this evaluation challenge:

- There is **no counterfactual** for an analyst to observe what would have occurred in the absence of that agency.
- There is a **time-lag problem** for RIA actions to produce their effects, making it difficult to track effects over time.
- The **attribution problem** renders it difficult to observe changes in the innovation system and attribute those changes to agency action.
- There is an **unclear reference** for the evaluation. What are the goals assigned to an RIA within the regional innovation support system? This is often not articulated explicitly. It is difficult to qualify results with respect to unclear expectations. Scottish

Enterprise is a good example with explicit targets for its various missions. A recent evaluation generated drastic changes in its mission, showing that impact assessment can serve to redefine a mission.

Because an agency is part of the innovation system, assessing its effectiveness requires assessing its role and place in that system. Improving its own internal effectiveness will not be sufficient to improve overall system effectiveness. This is even more difficult in the case of changing mandates among support institutions, as observed in the case of Scottish Enterprise, whose role in the system underwent major change. Systemic evaluations are needed to clarify the RIA role. In Flanders, systemic evaluations will explore the role of IWT in the wider perspective of regional innovation promotion instruments.

For agencies such as the ROM or IDC, which have a wider innovation promotion role, it is very difficult to measure results on the basis of traditional indicators. Assessment of the evolution of the innovation culture and the quality of partnerships, among other factors, should be considered, but are hard to measure. Bretagne Innovation, the regional innovation agency in Brittany (France) approaches evaluation from several perspectives (see Box 5.3).

### Box 5.3. **Bretagne Innovation: evaluation approaches**

Bretagne Innovation is the regional innovation agency for the Brittany region of France. The agency recognises that evaluating innovation support at regional level is needed to help the agency evolve. A shared and co-ordinated regional approach is considered important because the result can be considerably greater, or considerably less, than the sum of the individual parts of the innovation system. A shared methodology for evaluation enables comparison, even across different regions. The agency has found that impact assessment is costly but essential. Developing an evaluation culture was also observed to reduce resistance to change. Ideas are generated from the differences in the priorities, actions and perceptions among different system actors regarding innovation support. The agency therefore takes a three-level approach to evaluation:

- **Evaluate the innovation strategy:** using outside consultants, once every three years.
- **Evaluate implementation:** results compared to priorities, compilation of annual data, benchmarking with other regions, evaluation of impact every two years using company surveys and interviews, feedback for continuous improvement.
- **Evaluate the effects of agency actions on regional development:** While it is difficult to measure the effects of innovation support actions on regional development, two tools are developed by the region to shed some light. First, a categorisation of regional public expenditures for innovation according to the various goals (along the Impactscan methodology). Second, an Innovation Index was developed and includes:
  - **Inputs - innovation potential (people, education, research):** number of researchers, firm expenditure for training, number of private consultants, secondary and higher education results, and participation in European R&D projects; and
  - **Outputs - quality jobs, standard of living:** companies in high-tech industries, per cent of new products, exports, value of fiscal incentives, number of innovative young firms, patents, number of graduates/doctorates staying in the region, per cent of national grants distributed in the region, and starts-ups.

*Source:* Presentation by Bretagne Innovation at the joint OECD-Council on Competitiveness Experts Meeting, 2 July 2008, Washington, DC.

### *Networked versus centralised model*

The networked and centralised models co-exist in the real world of regional innovation agencies, including a variety of hybrid forms in between. An agency which is only a light node in a wider system is at one extreme. An agency which is a self-sufficient one-stop-shop internalising most of the support functions and policy instruments in-house is at the other extreme. The IDC in Sweden is closest to the network model, while IWT is a large one-stop-shop, though not at the other extreme since it manages a network of numerous other intermediaries. Scottish Enterprise moved from the position of a large all-encompassing agency towards one with a more focused mission. The challenges differ between the two extreme types.

The "light node" agency faces the main challenges of legitimacy for, and capacity to, effectively co-ordinate a wide array of other regional innovation support actors. The goal of aligning its mission and activities around a wider generic goal for the regional innovation policy is certainly not easy to reach. This is what IWT tries to achieve with the establishment of the VIS, the network of innovation intermediaries in Flanders. The network relies on a robust monitoring system to provide more coherence and visibility to the whole support system. Several conditions need to be present to ensure the effectiveness of the network model: *i*) an overall clear vision for regional innovation policy translated into clear objectives; *ii*) a good picture of the delivery system and knowledge of the regional system of actors; *iii*) a mechanism of powerful incentives to ensure joint performance of the system; *iv)* credibility and legitimacy of the agency in charge of co-ordination; and *v*) professionalism in the networking and match-making mission, among others. The more diverse the set of service providers, the more difficult it becomes to achieve effective co-ordination and synergies. Innobasque (Basque Country, Spain) is an example of the "light node" agency approach, with a focus on co-ordination and not direct service delivery (see Box 5.4).

#### Box 5.4. **Innobasque: a "light node" agency approach**

The Basque Country (Spain) is a region of 2.2 million inhabitants. During the 1980s, the region underwent a severe economic, political and social crisis with high unemployment and the collapse of basic industry. The Basque economy was restructured after the recession, supported by the region's business development agency SPRI. This was termed by the region its "First Great Transformation". Now the region has above average GDP per capita and growth rates relative to OECD regions.

To lead the process of the so-called "Second Great Transformation", the Basque Country is seeking to build an innovative society in all aspects. To complement the actions of the service delivery agency, the public-private partnership Innobasque was launched in 2007. The agency has a small budget (approximately EUR 6 million) but plays an important networking role for the region with a board of directors composed of leading innovation system actors. It also raises public awareness of innovation with a wider range of stakeholders than traditionally reached with innovation policy. There are over 40 cross-sectoral working groups involving hundreds of regional actors. The areas of focus for the agency include: *i)* technological innovation; *ii)* social innovation; *iii)* internationalisation of the Basque innovation system; *iv)* business and organisation transformation; *v)* advanced entrepreneurship; *vi)* communication and promotion; and *vii)* regional development.

*Source:* OECD (2011), *OECD Reviews of Regional Innovation: Basque Country, Spain*, OECD Publishing, Paris.

The "one-stop-shop" agency runs a higher risk of sclerosis and immobility, due to its large structure. Thus the core challenge for such an agency model is to develop internal organisational agility. Professionalism of staff and the use of goal-oriented management and evaluation are key requirements for the success of this model. The case of Scottish Enterprise illustrates this challenge: an evaluation highlighted the agency's risk of becoming rigid and the need for the staff to have greater knowledge of their target group.

### *Mission definition: innovation specialisation or broader regional development mandate*

Agencies can be dedicated to innovation promotion only (as is the case for IWT), or include this mission among others in a broader economic development mission (this is the case for the other three agencies). In between, there are development agencies with a generic mission that includes a greater, or lesser, focus on innovation. Among the three generic agencies, Sweden's IDCs present a less intense focus on innovation than the ROMs and Scottish Enterprise. The larger the degree of agency autonomy, the wider the diversity in missions observed among different agencies in the same country. In the Netherlands, a study found that the focus on innovation is largest in the Limburg agency, due principally to the prevailing innovation-oriented regional business fabric, but also to strategic decisions by its board of directors. Arguments in favour of a dedicated innovation agency suggest that the agency's stability would help policy makers focus on long-term objectives. The concern is that these long-term objectives would otherwise be over-shadowed by more politically attractive objectives which deliver quicker or more visible results (such as "brick and mortar"-based interventions). This is also a generic argument for agencification: to dissociate shorter term policy concerns from the long-term needs for policy operations. The case of IWT illustrates this option.

Arguments against a dedicated innovation promotion structure are linked to the policy fragmentation debate. By including innovation promotion inside a single structure in charge of economic development broadly (infrastructure, skills and training, export promotion, etc.), such as Scottish Enterprise or the Dutch ROMs, it is theoretically easier to achieve more integrated policy mixes. The condition for integration is of course that the agency's internal organisation favours such synergies. This integration has indeed been found as a positive element in the ROMs. Their "hard" investment functions give credibility to the "softer" mission and advising functions of ROM advisors. This model also demands a range of competences within a single agency. Small agencies such as the Swedish IDCs are designed recognising that innovation is a multi-faceted phenomenon. Hence the agency sees innovation as a holistic process, of which managerial capabilities and skills are the core. The suppression of the "skills and training" function from Scottish Enterprise casts doubts on the capacity of the agency to manage this function efficiently in the past. The regional development agencies (RDAs) in England had a different model than Scotland given the asymmetric decentralisation in the United Kingdom. The model of these agencies, which since the 2010 elections are being restructured to favour more localised development approaches, was based on a wider regional development mandate (see Box 5.5).

### Box 5.5. **RDAs in England: managing innovation and regional development**

The regional development agencies (RDAs) in the United Kingdom were created by legislation in 1998 and following the 2010 elections are being disbanded in favour of more localised development approaches. The five statutory purposes of an RDA at its origin, applying to both rural and urban areas, were:

- to further the economic development and regeneration of its area;
- to promote business efficiency, investment and competitiveness in its area;
- to promote employment in its area;
- to enhance the development and application of skills relevant to employment in its area; and
- to contribute to the achievement of sustainable development in the United Kingdom where it is relevant to its area to do so.

Given a failed Regional Assembly referendum, the RDAs at the time were the principal economic development agents at the regional level, working in partnership with a range of local and national bodies. The RDAs operated under a ten-year regional economic strategy and a three-year corporate plan. The corporate plans were produced annually on a rolling basis, and every second plan was submitted to the central government.

Given this very broad mandate, innovation was only one of many RDA responsibilities. RDAs controlled only a modest share of the public funding to support innovation in the regions. The spending in regions on innovation is significantly less than the allocable national science and technology expenditures that flow to the regions. Given that some areas of enterprise support also support firm efforts to increase productivity, if the wider enterprise support figures are included, the total share of RDA budget allocations to innovation and enterprise support among Northern regions was 35% (North West region) 44% (North East region), and 33% (Yorkshire and the Humber). The investments by RDAs in innovation were expected to contribute to increased productivity to support economic growth.

*Source:* OECD (2008), *OECD Reviews of Regional Innovation: North of England, United Kingdom*, OECD Publishing, Paris, doi: 10.1787/9789264048942-en.

### *Stability versus experimentation*

Stability is important for an agency's customer base. Simplification of the public support system can also increase agency visibility. From an internal perspective, stability also allows staff to specialise and promotes the accumulation of experience, which in turn contributes to the credibility of staff with clients.

However, a stable agency will face more difficulty to re-orient its missions and activities according to new emerging needs or evaluation results. Agencies focused primarily on stability run the risk of inducing regional actors to stay locked into existing development paths, rather than helping them explore new ones.

Regional agencies as change agents in a system should be able to deliver their services "a step ahead" of their customer base. They need to respond to latent system needs as well as those that are expressed. This ability to anticipate system needs was one of the most important challenges identified for the Swedish IDCs.

### *Funding structure*

There is also tension between stability and agility in the funding structure of RIAs. Agencies that benefit from stable funding sources can more easily plan their work, define strategic orientations based on a clearer view of future resources, and maintain qualified personnel in-house, or recruit new personnel. But they also face fewer incentives to deliver efficiently and effectively. The case of IDCs in Sweden illustrates the difficulty for planning when funding is allocated annually without commitments for future budget years.

Agencies for which funding is heavily dependent on performance are more likely to implement their actions more efficiently. The performance targets provide a clearer mandate to define their role and, with sufficient flexibility in implementation, fine-tune their portfolio of activities and become more effective. When there is competition between several agencies, performance-based funding can serve to focus resources on the best-performing agents and eliminate redundant or inefficient ones. An agency with a highly unstable funding base faces challenges for management and human resource policies. A high share of resources coming from commercial activities is an indication of success, but does not necessarily broaden the base of innovative enterprises.

The case of IDCs in Sweden illustrates that in certain circumstances, commercial success may mask other problems. One IDC in the country was found highly dependent on a single large firm, and hence failed its public mission to increase the number of innovative SMEs. The public funding base for Scottish Enterprise was noted as a risk with respect to agency agility and effectiveness. Dutch ROMs, with a large budget share originating from risky investments in innovative businesses, are likely to be driven more by future-oriented considerations than by stability.

### *Territory definition*

Most agencies operate within administrative boundaries because they are partly financed by regional authorities accountable to their citizens. This is the case for IWT and Scottish Enterprise, whose target groups are firms (and public research organisations) located in the region. There is a correlation between the strength of the regions in their national context and this limit of administrative boundaries. The cases of Flanders and Scotland are emblematic of regions with a strong identity and a clear strategy to strengthen autonomous powers.

However, innovation is a borderless phenomenon. Hence the challenge for RIAs is to take into account outside sources of knowledge and actors, while maintaining a focus on regional actors as target beneficiaries. A more geographically open approach is easier to achieve when the agency's strategic goals are articulated around results rather than inputs. For example, Dutch innovation vouchers are available to regional actors but can be used with providers outside of the region or even the country (see Chapter 6 for a discussion on innovation vouchers). When agencies are managed as private companies, such as the IDCs in Sweden, activities appear to be less constrained by administrative borders.

There is also much scope for inter-agency collaboration and joint action spanning regional borders. Inter-agency action seems largely under-exploited due to a lack of results-oriented agency management. The European Research Area is paving the way towards international openness of innovation agencies. The Northern Way in England is an example of domestic cross-border collaboration across RIAs.

### *Defining the scope for intervention*

The RIA's policy mix can be drawn from a large set of possible activities (see Table 5.2). Some agencies promote a full range of activities; others focus on a limited number. The presence or absence of instruments to fund firms or infrastructure in the RIA portfolio influences characteristics of an agency such as size, funding structure, accountability mechanisms and the role of the agency in the system. The integrated Scottish Enterprise and IWT, also providers of direct funding to companies, have a larger and more diverse portfolio. The Dutch ROMs derive an important turnover from property sales and management.

An agency's choice of the right menu of services depends on five elements:

- The regional policy objectives to which the agency's actions should contribute.
- The structure of the innovation system and its needs in terms of market or system failures.
- The availability and quality of other services (public and private) accessible for the target groups. The agency should avoid unfair competition with, and crowding out of, private service providers.
- The opportunity to create internal synergies across elements of the menu. The case of ROMs illustrates successful synergies in combining innovation support with FDI promotion.
- The internal capabilities of the agency to deploy the activity effectively. The case of Scottish Enterprise shows a need to separate the training function from the agency mission, on the grounds that it would be implemented more effectively by another specialised agency.

Because agencies are part of the innovation system, this portfolio definition should consider the overall system, and not only internal agency issues. Firm representatives on an agency board of directors (such as the Industry Advisory Councils of Scottish Enterprise) help in this respect. Board membership should also include individuals with a forward-looking view on regional development.

Table 5.2. **Types of services delivered by RIAs**

| Type of support | Examples |
|---|---|
| Soft support to firms | **Generic support**<br>-Information provision<br>-Awareness raising<br>-Training<br>-Stimulation and/or running of networks and clusters<br>-Promotion of internationalisation<br>-Promotion of foreign investors<br><br>**Individual support**<br>-Coaching, advice<br>-Training<br>-Needs assessment, audit<br>-Support for start-ups<br>-Access to finance, intermediary with business angels<br>-Science and technology services |
| Finance | -Delivery of public subsidies and loans |
| Infrastructure provision | -Incubators<br>-Science parks |
| Support to policy | -Support to policy design (e.g. Structural Funds programmes)<br>-Monitoring and evaluation of regional policies<br>-Acting as a node for regional partnership<br>-Acting as a central co-ordinating body for a network of innovation support actors<br>-Regional marketing |

### *Summary of key challenges*

Drawing from the above analysis, Table 5.3 summarises the strengths, weaknesses, threats, opportunities and success criteria for RIAs.

Table 5.3 **SWOT analysis of RIAs**

| Category | Key issues |
|---|---|
| Strengths | -Knowledge of specific situation of local companies<br>-Proximity to local public and private actors in charge of innovation promotion<br>-Central position that can enhance regional partnerships and social capital, facilitator role<br>-Well-placed to achieve horizontal co-ordination of the portfolio of services |
| Weaknesses | -Unclear mandate<br>-Lack of impact evaluation<br>-Difficulty to find and retain qualified staff (due to unstable funding)<br>-Inward-looking perspective constrained by administrative boundaries – lack of vertical co-ordination |
| Threats | -Unfair competition with private service providers<br>-Fragmentation of projects due to agency need for fundraising<br>-Public status and absence of competition offers insufficient incentives for performance<br>-Inward-looking strategies – unnecessary competition with other regions |
| Opportunities | -Co-ordination and synergy of regional innovation support (to overcome fragmentation)<br>-Acquiring legitimacy through demonstrated results – need for strategic evaluations<br>-Development of tools and professional support for own governance and to fuel strategic policy intelligence<br>-RIAs as change agents in the regional innovation system, "one step ahead"<br>-Overcome administrative boundaries for effective innovation promotion |
| Success criteria | -Institutional recognition as a legitimate regional policy instrument<br>-Complementarity of services, either internally in the integrated model or externally in the networked model<br>-Flexibility in services portfolio definition (adaptability to new needs)<br>-Strategic management capacities<br>-Goal-oriented approach and (partly) performance-based funding<br>-Quality of human resources (professionalism, specialisation)<br>-Suitability of structural funding sources (not too high, not too low) |

## Conclusions: RIAs as learning organisations and change agents

The above analysis of RIA profiles and challenges, in light of the new conceptual framework for regional innovation policy, leads to the following concluding points.

- There is a need for explicit and **strategic innovation policy** as a founding piece for the definition of RIA mission, goals, and as a reference for effectiveness assessment. The bridge between broad policy statements and implementation is often weak or missing, limiting possible evaluations of agency effectiveness.
- There are **no overall best practice models for RIAs**, but different challenges faced by different models.
- Whatever the model chosen, RIAs are (sometimes key) **actors in the system**, not just structures to deliver services. Their overall influence on the evolution of the system needs to be assessed, as well as the results of individual actions or programmes. A robust view on a RIA's effectiveness requires a functional analysis of the whole innovation support system.

- The biggest challenge for RIAs is to **become change agents** for innovation-based regional development. Structures that are too static do not help in this respect. A focus on absorptive capacities and learning processes supports a change agent approach. This creates a radical departure from traditional missions based on resource allocation, rather than on networking and learning.
- Beyond the choice of structure, the effectiveness of an agency will chiefly depend on the **quality of the internal organisation** and whether it:
  - favours creativity and innovation in-house;
  - has outward-oriented skills to network and be embedded in a wider system (regional and beyond);
  - operates as goal-oriented;
  - employs skilled human resources that contribute to its legitimacy with clients;
  - allows agility to incorporate lessons and evaluations from past activities in future work (evaluations as learning devices);
  - possesses sufficient management autonomy, vision and skills to play its strategic role; and
  - is subject to the right principal-agent accountability mechanisms to serve policy goals and not only its agency goals.
- Last but not least, increased use of **strategic intelligence tools** in agency management, and more particularly, of systemic and portfolio evaluations integrating the dimension of behavioural additionality, is the way forward for RIAs to become effective change agents.

# Note

1. This chapter draws on an earlier paper by Claire Nauwelaers (2009). Comments on an earlier version of this paper by Karen Maguire, Claire Charbit and Andrew Davies are gratefully acknowledged.

# *Annex 5.A1*

## Case study summaries

Table 5.A1.1. **Summary of characteristics: case study RIAs**

| | Swedish industrial development centres | Scottish Enterprise | IWT Flanders | Dutch regional development companies |
|---|---|---|---|---|
| General presentation | A network of 22 regionally distributed, specialised business advisory centres, business-oriented and -run, focusing on innovation support to SMEs. Partly State-funded. Variety in size and profiles across regions | A single agency in charge of a broad regional development mission, funded by the regional government. Deploys a wide range of services and funding schemes with a focus on priority sectors. Underwent reorganisation and downsizing | A large regional agency responsible for innovation promotion through R&D and technology. In charge of funding industrial R&D in public and private sectors, and co-ordination of intermediaries network | The four agencies serve as regional arms of the Ministry of Economy for its regional development and innovation policies. In charge of support to innovation, FDI attraction, and start-ups. Variety of forms across regions, which do not coincide with provincial administrative boundaries |
| Size | From SEK 2 to 60 million turnover depending on the centre | Downsizing<br>Total annual budget: GBP 550 million (2007), GBP 300 million subsequent years<br>Staff: from 2 000 down to 1 100 | Annual budget EUR 288 million and increasing<br>A staff of 125 | Between 29 staff and EUR 5 million turnover in the smallest company, to 57 people and EUR 8 million in the largest |
| Scope of intervention | -Support for innovative product development (loans)<br>-Feasibility studies (start-ups)<br>-Business advice, coaching, market analysis<br>-Intermediary with S&T sources, technology brokerage<br>-Competence development (training, life-long learning supply) | -Support to start-ups<br>-Funding of research in HEI leading to high-tech start-up creation<br>-Risk capital<br>-Technology institutes, undertaking market-led technology research<br>-Subsidies for R&D in companies<br>-Funding for post-graduate students at Scottish Research Institutes of universities<br>-Support for expansion abroad and export, FDI<br>-Investments in infrastructure | -Subsidies for R&D in companies, special SME programme<br>-Subsidy for industry-oriented public research, collective research<br>-Grants for researchers<br>-Co-ordination of intermediary networks<br>-Funding of intermediaries | -Development and innovation: promotion activities, information diffusion, support to development of firm clusters and networks, establishment of knowledge clusters with firms and knowledge institutions, and support to start-ups<br>-Pre-finance loans for projects<br>-Foreign investment promotion<br>-Equity participation (mostly) in start-ups<br>-Land and buildings for establishment of companies |

Table 5.A1.1. **Summary of characteristics: case study RIAs** *(cont'd)*

| | Swedish industrial development centres | Scottish Enterprise | IWT Flanders | Dutch regional development companies |
|---|---|---|---|---|
| Target of intervention | SMEs and start-ups at all levels of technology intensity. Focus on starting phase of innovation | Companies in priority sectors, start-ups, research institutes. Start-up phase and business development | Companies, special focus on SMEs, research institutes for applied research | SMEs and start-ups in priority sectors. Focus on starting phase of innovation |
| Degree of vertical integration | Low: IDCs appear mostly as intermediaries in the system, with a mission to refer clients to external sources | Large: Scottish Enterprise is a one-stop-shop agency with many services in-house. Skills and training and first-stop advice recently transferred | Medium: integration of S&T&I services in-house, and co-ordinated via VIS network, economic development apart | Medium: a number of in-house services but important collaboration with other service providers |
| Funding model | IDCs are funded in a variable proportion by private revenues and a limited-in-time State appropriation for its public mission | Funding comes mainly from regional government | Funding comes mainly from regional government | One quarter from national and provincial sources, large part from revenues from investments in companies, land and buildings |
| Services Professionnalisation | Highest for training activities | High: Performance monitoring carried out. Customer satisfaction monitored | High: performance control and audits, customer satisfaction surveys and evaluations carried out | Evaluations surveys regularly carried out. Quality of professional management according to external evaluation |
| Linkage with regional development policy | Most IDCs are part of regional growth agreements but they are not in charge of implementing this policy | SE is the central arm of the Scottish government: it is a main actor for delivering regional policy | IWT is closely linked, executes and contributes to the development of regional innovation policy | Direct connection: ROMs are arms of the national ministry for its regional development policy |
| Sector focus | Each IDC is specialised in a sector or technology, together they form a network | Focus on priority sectors (high-tech). Minor priority on activities of local importance | No sector priority, but the government invests in dedicated competence centres | Target towards most promising sectors (focus and mass) |

Table 5.A1.2. **Summary of key issues: case study RIAs**

| | Swedish industrial development centres | Scottish Enterprise | IWT Flanders | Dutch regional development companies |
|---|---|---|---|---|
| | | **Agencies as part of the system** | | |
| Place of agency | A small actor in the system, at the core of business networks | A core actor in the system, but losing importance after the transfer of some functions. Concentration in "top" sectors | A key actor in the system, a reference point for R&D and technological innovation | An important actor in the regional system, well networked with complementary bodies |
| Role of agency | Facilitator, intermediary, and resource provider to a lesser extent. May be weak as a change agent due to focus on limited forms of support to existing local firms | Scottish Enterprise is a resource provider (several programmes to fund firms and infrastructure). Cluster facilitator in key sectors. Positions itself as a change agent towards industrial restructuring in key sectors | Resource provider through grants. Facilitator through co-ordination of intermediaries network VIS | Resource provision (equity participation and grants). Facilitator though efforts towards clusters and networks creation. Potential change agent by supporting major innovative projects |
| Rationale for intervention | Mostly learning failures, system failures (fostering interactions and linkages), market failures (funding gap for new projects) | Market failures (funding gaps). System failures (technology brokerage). Learning failures through tailor-made advisory support to companies | Market failure (R&D funding), system failures (knowledge flows) | Market failures with seed capital and equity participation. Systemic failures (interface between companies and other actors) |
| | | **Enterprise-centred innovation system** | | |
| Innovation definition | Wide view of innovation based on market opportunities, organisational aspects. No restriction to services covering any aspects of innovation process | Focus on technological innovation and commercialisation of research base. Innovation as a multi-faceted process, including internationalisation. | Focusing on technological innovation, prospects towards broader definition, but implementation of this extended view still unclear | Wide view on innovation incorporating technological, managerial, and marketing elements |
| Target of instruments | Firm absorptive capacities, managerial abilities, competences development, life-long learning attitudes | Technology transfer, funding mainly. Tailor-made advice considering managerial learning and organisational capacities | R&D and technology transfer | Targets absorptive and managerial capabilities. Infrastructure and capital provision |
| Learning channels for innovation | Firm networks mainly, also connection to knowledge providers | Industry-science relationships. Firm clusters | Fostering public-private co-operation in R&D | Firm networks mainly, also connection to knowledge providers |
| | | **An open territory** | | |
| Territory definition | Functional definition, but rather limited scope | Regional borders and consideration of sub-regions | Regional borders but growing concern for system internationalisation | Functional definition, partly overlapping with provinces |
| | | **Constructing regional advantages** | | |
| Mission | Fostering innovation in SMEs, broadening the base of innovative companies. Not clear that IDCs act as change agents due to likely focus on existing activities (success in this respect varies across IDCs) | Growth of future-oriented, promising key sectors. Targeting both existing and new firms | Support innovation in the region through the exploitation of science and technology. Mostly addressing innovative companies, but also broadening its base through the diffusion of new knowledge | Focus on future-oriented sectors with critical mass. Some ROMs are positioned as change agents by initiating and supporting new endeavours |

Table 5.A1.2. **Summary of key issues: case study RIAs** *(cont'd)*

| | Swedish industrial development centres | Scottish Enterprise | IWT Flanders | Dutch regional development companies |
|---|---|---|---|---|
| | | **Smart policy mixes** | | |
| Instruments | Loans, advice and training offer, linkages to other sources, no guarantee that the mix is balanced | Subsidies, risk capital, infrastructure, business advice. Industry Advisory Councils may foster integration of policy portfolio. The individual "account managers" care for SE services integration | Subsidies and soft advice. No integrated policy mix evaluation but many single programme evaluations and reviews have enlightened complementarities. Rationalisation of portfolio took place | Mix of soft services, interfacing mission, capital provision, infrastructure and brokerage with other actors. Complementarity across the range of activities assessed as good, especially for innovation and seed capital |
| | | **Policy co-ordination** | | |
| Organisation of intervention | Co-ordination with other providers is within the mission but fragmentation is likely | First-line support and training are now in separate organisations (this may impede co-ordination) Concern for, but no evidence of, policy co-ordination with other agencies and levels (training, local governments, EU for ERDF). Low, according to Lyall (2007). | Co-ordination of innovation service providers is a mission, undertaken with increasing use of strategic intelligence tools. No clear evidence of co-ordination with economy department | Complementarity with other actors has been positively assessed. Target groups and missions are well defined and differentiated |
| | | **Strategic policy intelligence** | | |
| Goal definition | Fine-tuned to specific local circumstances. Driven by business views and needs, not so much by analysis of past results and successes | Strategic studies carried out and Industry Advisory Councils ensure linkage with firm needs. Major reorganisation following an official review. Large dependence on public funds does not favour agility | IWT's mission is evolving in an incremental manner over time, following reviews and evaluations. The latter have brought feedback from companies into programme design | Reviews and performance assessments are carried out. Mostly top-down definition of mission by Ministry of Economy, but room for regional diversity |
| Accountability and monitoring mechanisms | Due to private nature of IDCs, results-oriented management is the rule. Additionality not explicitly demonstrated | Indicator-based monitoring system, mostly results oriented, evolving towards impact assessment. Additionality explicitly considered | Combination of administrative and goal-oriented control mechanisms. The Flemish Council provides advice based on systems overview | Targets are set and monitored, and used for performance-based funding. External in-depth evaluation in 2004 |
| Evaluation focus | Focus on results rather than on impacts. No measure of behavioural additionality although this is the focus of intervention | Focus was on results and evolving towards impact. Additionality of SE services in terms of business turnover, additional R&D and leverage on investments is measured. The 2007 evaluation suggests that part of SE activities did not meet expectations and hence were transferred to another body | Evaluations increasingly focus on behavioural additionality. Evaluations used as learning device, and integrated into the "Monitoring and Analysis" unit of IWT. Use of international benchmarking | Many initiatives are evaluated, incorporate behavioural additionality, focus on impacts. Transfer of good practice from one ROM to another |
| Management style | Difficult to ascertain and variable across IDCs. Flexible and learning-oriented, but lack of prospective capacity in some cases | No evidence available. The 2007 reorganisation called for cut in top functions and more staff in direct contact with businesses. A possible sign of rigidity | No evidence available, the monitoring and analysis activities provide stimulus for in-house learning | Quality of management positively assessed in external evaluation |
| Autonomy | Large degree of autonomy, decisions by Board led by business executives | Large degree of autonomy of Board | Autonomy within a large range of programmes; the government decides on large investments | Little autonomy for broad mission definition, large autonomy in programmes and launching of new initiatives |

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# Part II

## *Chapter 6*

# Policy instruments for regional innovation

*This chapter reviews seven instruments frequently used in regional innovation policies. The instruments covered are:* i) *science and technology parks;* ii) *systemic initiatives: clusters, networks, competitiveness poles and competence centres;* iii) *innovation advisory services for existing SMEs;* iv) *support to innovative start-ups;* v) *innovation vouchers;* vi) *schemes for talent attraction and retention; and* vii) *funding for research infrastructure. The description of each instrument addresses its definition, rationale, objective, and the specificities for use at regional level. The description also highlights the adaptation of the instrument over time, including changes in policy concepts or evolving context conditions. Success factors and results from available impact assessments are also discussed.*

## Introduction

Innovation policy for and by regions is a young policy field. Yet, it already has a rich history and shows interesting evolutions, especially since the mid-1980s. Since then, there has been considerable experimentation with new policy initiatives and periods of fashionable policy ideas. Some policies have evolved and been modified by practice and by the specific national conditions within which they have been implemented. A policy instrument developed in the United States, for example, becomes subtly different as it is applied throughout European countries. Other policies have been launched to address newly recognised gaps.

The OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy indicated that the majority of innovation policy instruments are used at both regional and national policy levels. Hence there is not one type of region-specific portfolio of instruments (see Chapters 2 and 3). This fact creates a double need to: *i*) clarify the respective roles of regional and national authorities when designing and implementing the instruments; and *ii*) ensure complementarity among instruments used to promote innovation both within and across levels of government. It is also important that each instrument is effective in reaching its own objective.

This chapter presents a review of seven innovation policy instruments that are used frequently or are highly relevant for regional innovation policies. The chapter focuses first on those instruments which are, according to the OECD-GOV Survey, more frequently used at regional than national levels. Such instruments are: science and technology parks as well as systemic initiatives (clusters, networks, competitiveness poles and competence centres). Second, the chapter covers instruments that are frequently used at regional level while falling also under the realm of national policies: innovation advisory services for existing SMEs and support to start-ups. And third, the chapter reviews instruments which are more frequently managed at a higher level but nevertheless also appear in a significant number of regions' policy portfolios: innovation vouchers, schemes for talent attraction and retention, and funding for research infrastructure.

These instruments have varied histories. Some are traditional instruments which have been used for several decades; while others are emerging instruments still in the experimental phase (see Chapter 2). They can generally be related to different phases in the history of regional innovation policies more broadly, which can be viewed through a simplified sequence of phases (Charles and Uyarra, 2010).

- **Phase 1: Regional innovation as physical development – silicon landscapes:** early attempts in the 1970s and early 1980s to influence regional innovation typically focused on physical developments such as science parks and the relocation of research labs. The innovation model was heavily predicated on the linear flow of ideas from research into industry. Policy focused on relocating research to those areas with low levels of R&D, as well as on the development of science parks to attract research activities and to facilitate spin-offs and knowledge exchange with universities.
- **Phase 2: Supporting technology transfer and enterprise:** in the early 1980s, alongside the science park movement but much less visible, was the development of incubators and technology transfer agencies, sometimes embedded in science parks and sometimes based in other agencies. These entities became more common and central to policy in the late 1980s and early 1990s as the limitations of science parks were widely

recognised and greater priority was given to increasing the number of innovative SMEs. Innovation policy therefore emphasised these "softer" business support measures for technology transfer.

- **Phase 3: Regional innovation as networks – regional innovation strategies:** Following the profusion of new initiatives during the 1980s and early 1990s, and in the EU at the encouragement of the European Commission, regions began to co-ordinate activities through regional innovation strategies. The core objective was to gather together policies and initiatives towards a common strategy. This approach was based on the emerging understanding of regional innovation systems, including greater recognition of the importance of networks among firms and the identification of clusters. Many regional innovation strategies focused on cluster development in the late 1990s. "Soft" services for innovation in SMEs, including start-ups were promoted. In many respects this phase is still ongoing.
- **Phase 4: Regional science policies:** finally, in more recent years, there has also been a greater focus on the research base in regions. Policy has prioritised research-driven clusters. In many cases, regions have taken on greater roles in basic science policy as a result of devolution. The policy emphasis has returned to research infrastructure again in the form of large science investments and science cities (2000s), as well as in the form of infrastructure characterised by public-private partnerships, such as competitiveness poles and competence centres.

The discussion of each instrument in this chapter starts with a definition of its rationale and objective. A clear description of its characteristics is important, as in practice seemingly identical instruments can be very different. Some policy instruments, such as support to start-ups, are in reality diverse packages of instruments within a large menu of possible options. The role of the instrument from a regional perspective is discussed. The adaptation of the instrument over time, following changes in policy concepts or evolving context conditions, is addressed. A large variety appears within each type of instrument, reflecting its evolution. Success conditions and available knowledge on impacts are summarised for each instrument. Table 6.1 provides a snapshot of all these key points for the seven instruments.

In most regions, these policy instruments are not implemented in isolation but as part of a smart policy mix (see Chapter 2). Each instrument may require that others are implemented effectively. For example, cluster policies and research infrastructure work together in supporting the emergence of science-based clusters, while science parks and science cities may provide accommodation or governance structures. Financial support to firms is often complemented with soft support. Programmes to promote innovation among existing firms coexist with support to new firm creation, venture capital, entrepreneurship, information infrastructure, and human capital development. The smart policy mix should be unique and fitting to the nature of the region.

Table 6.1. **Overview of policy instruments used to promote regional innovation**

| | |
|---|---|
| **Instrument 1. Science and technology parks** | |
| Definition, rationale and objectives | Places with physical infrastructure, often accompanied by a range of services, where companies and research institutions are co-located with a view to benefit from joint location. Science parks have a greater focus on research, technology parks on firms.<br>Rationale: science can lead to economic growth through the creation of new technology-based firms (NTBFs) and commercialisation of research. Three objectives: economic development (NTBFs, attraction of new industries, etc.), transfer of technology (academia to industry), and local benefits (job creation, cultural change, image). |
| Regional dimension | Science and technology parks capitalise on proximity to enhance knowledge flows among tenants. Regional authorities invest in parks for regional restructuring purposes; national governments focus more on technology development and foreign investment attraction. Science and technology parks may play the role of regional facilitators and service providers in regions lacking regional innovation agencies. |
| Evolution over time and variety | First generation: large scale parks, linked to universities, focused on large firms and contracts with universities.<br>Second generation: smaller parks, associated with restructuring strategies, with a focus on new firm creation, and the central role of incubator facilities.<br>Third generation: larger scale initiatives linked to city strategies, strong focus on image improvement, provision of facilities for foreign firms and new domestic technology firms.<br>Recent trend of convergence between park and cluster initiatives. |
| Success conditions and impacts | Several evaluations shed doubts on the additionality of science and technology parks. Effects of parks on firms located in the park (as compared to firms located outside) are ambiguous. There is a selection bias in firms that tend to locate in a park. Effects in terms of regional engagement of universities is more visible but small.<br>A challenge is to achieve a good balance between economic development and technology transfer objectives of the park (focus on high-technology industry versus commercial viability of the property development). Conflicting objectives and unclear objectives complicate evaluations. |
| **Instrument 2. Systemic initiatives: clusters, networks, competitiveness poles and competence centres** | |
| Definition, rationale and objectives | Clusters are modes of organisation of the productive system, characterised by a geographical concentration of a critical mass of economic actors and other organisations, specialised in a common field of activity, developing inter-relations of a market and non-market nature, and contributing to innovation and competitiveness of its members and the territory.<br>Business networks do not necessarily have to operate in related industries or be geographically close. Networks are groups of firms with restricted membership, whereas being part of a cluster or cluster association can be open. Clusters often include networks.<br>Competitiveness poles are co-operative partnerships of companies and research organisations aiming to support innovation: competence centres have a smaller dimension and scope, and a greater focus on R&D than competitiveness poles.<br>New approaches in regional, industrial and technology policies have provided rationales for cluster policy that go beyond market failure rationales of technology policies and combine the interactive element of the innovation process with a market-oriented approach to new forms of industrial policy.<br>Objectives:<br>• address innovation system failures;<br>• capitalise on tacit knowledge that is not transferrable at a distance;<br>• improve internal and external connectivity of regional innovation actors; and<br>• increase attractiveness of the region through the creation of critical mass in specific areas. |

Table 6.1. **Overview of policy instruments used to promote regional innovation** *(cont'd)*

| | |
|---|---|
| Regional dimension | Interactions are facilitated by spatial proximity as there are untraded interdependencies that are fostered by face-to-face exchanges: clusters, networks, poles and competence centres benefit from being managed at the regional level.<br>Competitiveness poles typically have a global dimension.<br>Multi-level governance mechanisms are required for cluster, network and poles policies. The local and regional levels are more aware of local specificities and can help SMEs to seize opportunities and access wider networks. Co-ordination with instruments from the national level is necessary to exploit synergies across funding channels from various levels. A frequent division of labour for cluster policies involves selection by a higher level authority and implementation and facilitation at lower level. |
| Evolution over time and variety | Long-standing traditional industrial district policies. Porter inspired cluster policies in the 1990s. Upsurge of cluster initiatives since 2000. Trends are towards: broader policy initiatives; more focus on innovation; changes in instruments over time.<br>Cluster support policies vary on many dimensions: the broader (or narrower) understanding of clusters; cluster identification and selection; targets of policies; portfolio of instruments used; focus on nurturing new clusters or influencing existing clusters; government-driven efforts (top-down) or initiatives from private actors (bottom-up); leadership by various levels of governance: national, regional, local; etc.<br>Competence centres emerged in the early 1990s; competitiveness poles in 2000s. The differ along various characteristics:<br>• physical or virtual;<br>• distinct or integrated in universities;<br>• research- or industry-led;<br>• funding mix balance regional-national. |
| Success conditions and impacts | Few insights on cluster policy effectiveness. Surveys reveal a mismatch between what firms and institutions consider as the most relevant policy areas. Evaluations are more common for competitiveness poles and competence centres than for other innovation instruments.<br>Common pitfalls include: poor targeting; inappropriate policies due to high-tech myopia; danger of lock-in due to excessive specialisation; lack of private sector engagement; weak policy co-ordination; and difficulty to adjust policy to needs over time.<br>Seed funding is an option for governments to support cluster/cluster association formation but continuity of public funding can be important for on-going projects. Private participation in funding is required to ensure that clusters remain business-driven initiatives.<br>Initial endowments of expertise (firms and research institutions) matter. |
| **Instrument 3. Innovation support services for existing SMEs** | |
| Definition, rationale and objectives | Assistance to existing SMEs for innovation, not including direct financial support (grants, loans, equity):<br>• support in the form of advice and counselling for technology transfer and absorption; and<br>• support for improved innovation management and organisational change.<br>SMEs are the backbone of economies but innovate less and face disadvantages compared to large firms (access to finance, reduced internal resources, large fixed costs for regulatory compliance, etc.). Private service providers often find SMEs unattractive as a market and hence public action is justified by market failure. |

Table 6.1. **Overview of policy instruments used to promote regional innovation** *(cont'd)*

| | |
|---|---|
| Regional dimension | Regions present different innovation profiles, and SMEs in those regions display different needs and potential. This calls for differentiated innovation support.<br>Regional arms of national agencies can provide tailored services to companies and develop access to local knowledge sources, based on knowledge of regional players.<br>Synergies between regional and national support need to be developed. |
| Evolution over time and variety | Trend towards open innovation increases the range of opportunities for innovation in SMEs, but requires them to be more networked. This places more importance on support aiming to develop SME external linkages and absorptive capacities.<br>Broad concept of innovation expands the scope of support provided.<br>Cross-border support schemes are becoming more relevant to harness external resources for SMEs. |
| Success conditions and impacts | Identification of market and system failures that justify public action.<br>Good knowledge of SME needs and feedback in design of support services.<br>No direct way to link innovation support services and firm innovation and economic performance, but intermediary impacts need to be monitored. |
| **Instrument 4. Support for innovative start-ups** | |
| Definition, rationale and objectives | Three types of support:<br>• proof of concept grants;<br>• incubators and related advisory services; and<br>• funding of early-stage innovative companies (business angels, seed capital and early stage venture capital schemes).<br>Innovative new firms are seen as agents of change in the economy. Because of market failures and of system failures in certain markets, investments in innovation may fall short of the socially optimal level. |
| Regional dimension | Capitalise on proximity relationships, which facilitate access to resources and tacit knowledge, networking with partners, and the development of trust relationships.<br>Need for synergies with national support. |
| Evolution over time and variety | From firm creation towards firm competitiveness and growth.<br>Incorporating demand-side instruments into the policy portfolio.<br>Move towards vertically integrated policy mixes.<br>More consideration to diversity of needs of start-ups towards more flexible policy portfolios. |
| Success conditions and impacts | Need for more risk-capital and less fragmentation of support.<br>Risk and seed capital schemes need critical size and/or specialisation to work effectively.<br>Monitoring of policy impacts on start-ups problematic given lack of comparative indicators.<br>Regulatory barriers (e.g. for new firm creation) still impede the success of other initiatives. |

Table 6.1. **Overview of policy instruments used to promote regional innovation** *(cont'd)*

| | |
|---|---|
| **Instrument 5. Innovation vouchers** | |
| Definition, rationale and objectives | Funding allocated to companies in the form of a voucher to buy innovation services from knowledge providers. The company pays the researchers or consultants with the voucher, which in turn is reimbursed by the public issuer.<br>Facilitates company access to external knowledge while avoiding bureaucratic delivery problems (focus generally on SMEs).<br>Compensates for internal weaknesses of SMEs and reduced capacity to hire innovation specialists. |
| Regional dimension | Both national and regional bodies fund innovation vouchers.<br>Vouchers issued and managed by regional agencies often place a premium on the creation of regional linkages, even if links to external providers are increasingly promoted as well. |
| Evolution over time and variety | Started as a regional initiative in 1997 in the Netherlands, diffused at national level and in Europe since then. Explosion of schemes from 2006 and extension outside Europe. First generation focuses on technology, second generation on innovation more broadly.<br>Elements of diversity: focus on technology or innovation; generic or targeting of specific sectors; scope of eligible activities; range of eligible knowledge providers; domestic or cross-border scope; size of the voucher and of programme; rate of co-funding, etc. |
| Success conditions and impacts | Success factors: simplicity and low cost of procedures; clear definition of services linked to objectives; high qualification of service providers; finding a good threshold for the maximum support to be granted and an appropriate co-financing rate; target group representativeness; identification of suitable voucher quota; pro-active marketing of the vouchers by research and technology organisations.<br>Success assessment needs to incorporate secondary effects such as staff mobility. A main impact indicator should be the increase of the innovation capacity in the target group of SMEs.<br>Positive evaluations of the Dutch, Scottish and Finnish schemes. |
| **Instrument 6. Mobility and talent attraction schemes** | |
| Definition, rationale and objectives | Financial and non-financial schemes to attract and retain skilled people: career development schemes; inward mobility schemes; and outward mobility schemes. Forms include grants, loans and tax incentives.<br>Mobility of people is one of the important mechanisms of knowledge transfer, and contributes to knowledge spillovers. Attracting and retaining the creative class is a key challenge for knowledge-based economies, and this class is more mobile. Ageing societies face risks of labour shortages. |
| Regional dimension | Regional dimension of policy action is not clearly established, as most education and training initiatives and labour market framework conditions tend to be managed by the national level. |
| Evolution over time and variety | Policies for attracting international talent have a long history in the United States and Canada, with more recent attempts in Europe. Increased globalisation has raised the importance of talent attraction and retention schemes in innovation policy portfolios. Increased attention to lifelong learning programmes at universities. Trends of: broadening programmes to include provisions regarding living conditions and incorporating non-S&T fields (including artistic fields). |
| Success conditions and impacts | Talent attraction and retention schemes play a relatively minor role in people mobility. Other generic policies such as immigration policy, taxation and conditions of labour and housing markets play an important role. Evaluations of EU mobility schemes have demonstrated additionality. |

Table 6.1. **Overview of policy instruments used to promote regional innovation** *(cont'd)*

| **Instrument 7. Research infrastructure** | |
|---|---|
| Definition, rationale and objectives | Five types of policies:<br>• relocation of public research labs outside of the capital region;<br>• major research infrastructure;<br>• new universities in peripheral regions;<br>• regionally-based centres for industrial technologies; and<br>• new agglomerations of R&D in the form of science cities.<br>The rationale for establishing research infrastructure in the regions is linked to the potential for knowledge spillovers and contribution to regional development. |
| Regional dimension | The regional dimension in funding research infrastructure stems both from national strategies to support knowledge-based development in regions and from regional strategies oriented towards the development of a science base. This type of instrument is more dominant in regions with strong institutional powers in STI policy. |
| Evolution over time and variety | Rapid expansion of universities outside of capital regions starting in the 1990s.<br>Growing involvement of sub-national authorities in science cities.<br>Increased involvement of regional authorities in funding research infrastructure given higher priority on research and innovation in regional policies.<br>Increased involvement of national governments in supporting university "third mission", including linkages with SMEs. |
| Success conditions and impacts | Regional investments in research infrastructure raise questions concerning the appropriability of knowledge and the minimum threshold or scale for efficient R&D performance. A core challenge relates to the absorption capacity of the host region. Government responses seek to retain some of the benefits of agglomeration by focusing on locations that might have greater absorptive capacity or by creating new agglomerations away from the metropolitan cores. |

*Source:* Technopolis (2010), "Review of Innovation Policy Instruments", background paper for the OECD; Charles, D. and E. Uyarra (2010), "Practical Benefits of Innovation-related Policy Instruments at the Regional and Local Level", background paper for the OECD; OECD (2007), *Competitive Regional Clusters, National Policy Approaches*, OECD Publishing, Paris, doi: 10.1787/9789264031838-en.

## 6.1. Science and technology parks

### *Definition, rationale and objectives*

Science and technology (S&T) parks include a large variety of initiatives to stimulate the growth of high-technology employment and to encourage technology and knowledge transfer between universities and other research organisations and companies. S&T park objectives include: *i*) economic development (new technology-based firms, attracting new industries, etc.); *ii*) transfer of technology (between academia and industry); and *iii*) local benefits (job creation, cultural change and image) (Massey *et al.*, 1992)

S&T parks involve physical infrastructure, often accompanied by services, where companies and research institutions are co-located with a view to benefit from joint location. Beyond their variety, Link and Scott (2003) propose three common elements of S&T parks:

- a real estate development;
- a programme of activities for technology transfer; and
- a partnership between academic institutions, government and the private sector.

There are limitations to the physical infrastructure elements of the policy. The provision of high quality real estate on its own is unlikely to realise all of the claims made for S&T parks. The role of accompanying technology transfer and entrepreneurship support services is crucial.

The first science parks were launched by universities (Stanford and Cambridge for example). Their motivation was to raise revenues from land holdings, while enhancing their research status and encouraging technology transfer. The underlying rationale lies in a linear model of commercialisation, whereby knowledge production in the university leads to commercial exploitation and development through licensing of technology and other forms of spillover to firms in the science park, and through spin-off firms created by academic entrepreneurs. Science is viewed as a catalyst for economic growth through the creation of new technology-based firms. The public investment in science is expected to pay dividends through commercialisation that leads to economic benefits. Support for science-based development flowed from the success of initial parks and the wider success of high-technology firm clusters in the United States and to a lesser extent Europe.

A variety of labels can be associated to the generic term S&T park: science park, research park, technology park, innovation centre, technopole and even science city. In practice, many initiatives are covered by these labels, with different meanings depending on the national context. Five broad categories summarise the most common forms of S&T parks:

- **inner city innovation centres:** single buildings for multiple occupancy, located in an inner city with reasonably close access to a university;
- **campus innovation centres:** located on a university campus, mainly in a suburban or greenfield location;
- **classic ex-urban park developments:** large parkland settings on an ex-urban site, with a combination of multiple occupation and single tenant buildings. Development on the site may include both speculatively built and owner-occupied buildings. In many cases, the sites attract research and development or sales subsidiaries of large multi-national corporations;

- **urban business parks:** combine the locational attributes of the inner-city innovation centres with a more extensive site, including individual businesses with their own premises; and
- **science cities:** larger developments that go beyond the notion of the park and embrace entirely new city development strategies.

There are some distinctions between a research park and a technology park. A research park (more common in the United States or the United Kingdom) tends to focus on research activities and may have quite restrictive tenancy agreements. A technology park may be more widely defined to include some manufacturing or downstream activities with less focus on academic research. Some research or science parks are in reality little more than high-tech incubators – sheltered accommodation for new technology-based firms adjacent to universities, focusing on university spin-outs but also open to other new high-tech firms from the surrounding area.

Among S&T parks, several are of large scale or are S&T concepts at an urban scale. Large-scale urban parks, such as Research Triangle (United States), Hsinchu (Chinese Taipei) or Sophia Antipolis (France), contain residential and leisure facilities as well as research and business activities. Some concepts such as a technopolis, science city, technopole or high-tech quarter, refer to large-scale operations. By definition, a technopolis is a technological city, and as such would refer to cities with a high concentration of knowledge or technology generating activities (e.g. R&D, higher education, specialised information services). The Japanese technopolis policy is a public policy initiative on science and technology at the urban scale. Table 6.2 illustrates the variety in science city models across OECD member countries.

Table 6.2. **Science cities: an international comparison**

| | Science cities | Daedeok | Silicon Valley | Zhong-guancun Science Park | Hsinchu Science Park | Tsukuba | Kista | Oulu |
|---|---|---|---|---|---|---|---|---|
| | United Kingdom[1] | Korea | United States | China | Chinese Taipei | Japan | Sweden | Finland |
| Green-field location | | ⦿ | ○ | | ⦿ | ⦿ | | |
| Regional development goals | ⦿ | ⦿ | | | ⦿ | ⦿ | | ⦿ |
| Dominant national role | | ⦿ | | ⦿ | ⦿ | ⦿ | ⦿ | |
| Dedicated public investment | | ⦿ | | ⦿ | ⦿ | ⦿ | ⦿ | |
| National programme | ○ | | | | ⦿ | | | |
| Major research institutions | ⦿ | ⦿ | ⦿ | ⦿ | ⦿ | ⦿ | ⦿ | ⦿ |
| National R&D leader | | | ⦿ | ⦿ | | ⦿ | ⦿ | |
| Partnership models | ⦿ | | ○ | | ⦿ | | ⦿ | ⦿ |
| Flexible network models | ○ | | ⦿ | ○ | ○ | | ○ | ○ |
| Orientation to innovation | ⦿ | ⦿ | ⦿ | ⦿ | ⦿ | ○ | ⦿ | ⦿ |
| “New Argonaut” links | | | ⦿ | ⦿ | ⦿ | | | |
| Strong venture capital presence | | | ⦿ | | | | | |
| Public science education | ⦿ | | | | | | | |

Notes: 1) Northern England Science Cities of Manchester, Newcastle, York; 2) ⦿ = Strongly present; ○ = partially present. More ⦿s or ○s denotes that more factors are present, not that more factors lead directly to better outcomes.

*Source:* OECD (2008), *OECD Reviews of Regional Innovation: North of England, United Kingdom*, OECD Publishing, Paris, doi: 10.1787/9789264048942-en based on analysis by Dr. Phil Shapira for the OECD.

The science parks, high-tech quarters and innovation centres of Anglo Saxon countries are usually of much more modest scale and ambition. In the United States, quite large geographic areas may be included, but the degree of planning beyond that of restrictive zoning is small. In northern Europe and Scandinavia, sites are always small, and the incubator unit for new firms is the dominant model. Such sites may be elements of larger technology complexes at the urban scale, and in some cases are parts of new towns.

S&T parks usually incorporate hard and soft technology transfer services or other support for tenants, especially start-ups. Hard services include shared facilities, meeting rooms, secretarial support and other forms of service outsourcing. The cost of shared facilities, such as meeting rooms, may be partly incorporated into the rental cost for the park tenants but at below market rates. Shared secretarial services may be charged according to levels of use, for example to assist small start-ups. Sometimes these costs are subsidised for new firms for a period of time as part of a regional assistance programme. This model is most common to the innovation centres and incubators in Germany, Northern Europe, Scandinavia and the United Kingdom, for example, where the focus is on SMEs.

Soft technology transfer and consultancy services are also core to the functioning of S&T parks. To some degree, these may be offered free of charge as they are usually funded from regional support schemes. This public support is justified by the anticipation of further revenue from the licensing of technology or the sale of more specific services later. Services such as access to university libraries and facilities may be packaged into science park rent, along with advice on partnership opportunities and technical collaboration with the university. Many science parks have also sought additional regional funding for technology development schemes aimed at their tenants, such as student placement schemes and public support for university consulting – Warwick University Science Park in the United Kingdom has pioneered a number of such initiatives using EU Structural Funds.

S&T parks are meant to be selective initiatives with a focus on high-technology businesses; however, other firms may seek entry. The quality of premises might attract firms that do not match the profile sought by the park promoters. Most S&T parks operate some form of selection process for tenants to ensure that the objective of the park is preserved. Various criteria are used to restrict entry into S&T parks, although they are not always strictly applied. S&T park promoters must balance the economic development and technology transfer objectives of the park (which require a focus on high-technology industry), with the commercial viability of the property development (which requires rent-paying firms to ensure a return on park investment).

### *Regional dimension*

The origins of S&T parks often lie in an a-spatial concern for the commercialisation of university science and technology assets. Many S&T parks were established by universities primarily to fulfil their commercialisation strategies, not for regional engagement purposes.

Nevertheless, S&T parks are increasingly viewed as both a national and regional development tool. The regional approach to S&T parks seeks to build on local assets for development through the proximity of different firm and research actors or through the flow of graduates and university researchers. The initial role models of Silicon Valley and

Stanford convinced regional planners that the university could act as a growth pole. Planners and developers elsewhere endeavoured to stimulate informal links and the flow of people between universities and firms that was observed in the Silicon Valley. To achieve this goal, tools included: development of the right property close to the university; a technology transfer office to stimulate linkages; and typically social spaces to create an atmosphere of trust. In Australia, state governments have driven development of technology parks and innovation precincts. The focus has been less on urban regeneration and more on industry development and economic diversification in line with state government economic strategies. Some Australian parks have their roots in universities but others have developed without the presence of a university.

National governments are more concerned with large parks to support national technology development or inward investment strategies. Larger developments in Asia are national tools for the attraction of multi-national high-technology investment, or as a focus for national science and innovation policies, such as for Hinschu (Chinese Taipei), Daedeok (Korea) and Cyberjaya (Malaysia). Hsinchu is one of the largest parks and is akin to a science city as it includes residential and recreational areas as well as industrial space. In Ireland, the Plassey National Technological Park was a central government initiative, and an important element of national inward investment policy. There was also a strong regional perspective in which the university was seen as a significant resource for the regional economic development strategy. The park has adapted to shifts in the national strategic perspective as the initial high-technology inward investment strategy has been supplemented by supply chain-oriented policies, developing links between internationally oriented firms and local suppliers. In the same vein, the major thrust of Sophia Antipolis has been to attract large firm investments from overseas and elsewhere in France. Subsequently, this focus on larger investments has been adopted by parks in Portugal and Spain. In the case of the Taguspark near Lisbon, a number of existing research organisations have begun to cluster in this new development. The park has a strategic objective to assist the internationalisation of the Portuguese economy through the attraction of mobile investment in high-tech areas and was supported from national and EU Structural Funds as a national flagship initiative.

S&T parks are not restricted to high-tech, urban regions. Regional and local governments are also involved in parks with a view to regenerate declining industrial communities or even spur innovation in rural areas. Across Europe, this approach tended to be the dominant model, with regional governments in particular investing in innovation centres as well as larger parks, often with financial assistance from EU Structural Funds.

The significance of a science or technology park to a regional innovation strategy depends on the circumstances of the park as well as the region. If the park is set up by the region, it is considered a driver of change. If the park is established by a university or private developer, or with the aim to attract multi-national companies, it may lie outside the core of the regional strategy. Successful regions may attract park investors from outside the region, as the parks become a way of differentiating high quality space for a strong local demand from high-technology firms. In lesser developed regions, the establishment of a science or technology park may compensate for the absence of regional knowledge-based resources, but the risk is that it remains disconnected from the economic fabric, developing few relationships with regional actors.

The technology transfer and innovation support services provided in national parks may also serve as key regional providers to a wider set of firms. Science parks in Greece are national instruments that fulfil a wider regional development role (Box 6.1). This role is more restricted in countries where alternative regional agencies exist and where science parks are merely property-based initiatives with a limited degree of complementary services. Size is also a factor, as small parks and incubators can only provide limited services unless those services are being funded to support the region at large.

Box 6.1. **Science parks as national instruments and regional facilitators in Greece**

In countries with weaker regional infrastructure, the science park as an instrument of national S&T policy may play a central role as a holistic innovation agency. Provision of services both on and off the park is important. In Greece, science parks have taken on a facilitator role given the absence of regional technology initiatives and the academic orientation of the universities. A set of research institutes within the Foundation for Research and Technology Hellas (FORTH) have promoted this model, seeking explicitly to provide the foundations for a new regionalised research, technology and development infrastructure and to provide technology transfer support, especially from FORTH and university research. As a relatively underdeveloped economy with low levels of R&D investment, Greece had been slow to develop science parks, although there are now parks in many of the larger towns and cities, such as Athens, Patras, Heraklion and Thessaloniki. The latter three of these parks are all associated with FORTH institutions. Funding for the developments comes largely from the EU Structural Funds and associated national programmes.

*Source:* Charles, D. and E. Uyarra (2010), “Practical Benefits of Innovation-related Policy Instruments at the Regional and Local Level”, background paper for the OECD.

### *Evolution over time and variety*

The science park concept is usually credited to the Stanford Research Park, initiated in 1950, and the outstanding success of Stanford and Silicon Valley. However, there is no standard development model. As the most visible among early regional innovation policies, science parks captured the attention of local policy makers, journalists and university presidents. In the 1980s, they became synonymous with attempts to change the economic structure of regions and to foster technology transfer from universities. Unfortunately, the concept was believed to be a general panacea for economic development problems. Therefore, they were bound to have mixed results and limited impacts beyond park boundaries. Science parks tended to fall from favour and became a less prominent policy tool, although still maintaining their own networks and policy support community.

The first generation of research parks tended to be very large greenfield sites, in semi-rural environments, and with some formal relationship with a university. Parks were oriented towards large firms seeking to establish research facilities near a university environment, in the hope that firms would develop research contracts with universities. In the case of Stanford, the land was owned by the university. Stanford was a facility for multi-national research centres, whilst the small spin-off firms began in cheaper premises such as garages and starter units elsewhere. In many US research parks, there may be some manufacturing activity also, and this in part accounts for their large scale. Some of the early European experiments in science parks followed a similar model, notably Cambridge and Sophia Antipolis, although with some minor changes. The initial Cambridge Science Park was a smaller development and with a stronger focus on local start-up firms, and did not include manufacturing firms. Sophia Antipolis adopted the US model of inward investment and a large firm focus, but originally had only weak university links, and incorporated some residential land use. Canadian science parks also tended to follow the US model but on a more modest scale.

The major growth of science parks in Europe followed a new trajectory, or second generation, more adapted to the problems of industrial decline in older industrial cities. This was in the form of the incubator or innovation centre, a small-scale development adjacent to a university, fit into the urban environment with a focus on new firm creation. Some small-scale research parks continued to be built, at universities with semi-rural campuses, but especially in larger cities and particularly in Germany. The innovation centre model predominated in this second wave.

A third generation, following from the innovation centre explosion of the early 1980s, was a move back to a larger scale, including urban areas, but with specific site-based strategies. This is the technopole/technopolis approach: a city-wide strategy incorporating a number of technology transfer policies and inward investment support. It takes the form of one or more large research park sites, often coupled with other urban regeneration projects, with a strong image improvement and service sector orientation. In Asia, the developments have tended to be of larger scale and overlap with the idea of the science city. In some rapidly developing economies and in very large cities, the opportunity for large-scale investment has been very high, and the parks are correspondingly huge (Hsinchu has around 130 000 people employed in the park). These parks tend to be promoted by central government and are subject to national development policies. Cyberjaya in Malaysia was built between the new national airport and Kuala Lumpur, with fast road and rail links to the airport and high quality communications infrastructure to attract international ICT companies.

There has been some convergence between S&T parks and clusters with a thematic focus around regional high-technology clusters. Biotechnology is one sectoral focus – often fostered by regional biotech strategies. In Germany, regions developed strategies as part of their participation in the national BioRegio initiative. North Carolina State University's Centennial Campus is being developed around four main technologies which lie at the heart of the university's strategy – IT, genomics/biotech, advanced materials and environmental technologies.

### *Success conditions and impact*

The lack of clarity over the objectives of S&T parks puts constraints on evaluation. The different objectives can work against each other, such as those relating to innovation and technology transfer being undermined by commercial expediency in filling space. The strictness of criteria for entry will be weighed against the market premium for space rental based on tenant quality. Evaluating success is highly problematic, especially if it focuses on a narrow set of expectations related to a linear technology transfer approach.

A key problem in impact evaluation is the difference in objectives among participating actors and stakeholders. Universities expect science parks to help them commercialise scientific results, while entrepreneurs are looking for high quality accommodation and access to business services on site. Multi-nationals seek flexible accommodation for short-term projects with university partners. Policy makers at a regional level expect jobs and economic growth. Some parks are seen primarily as real estate ventures. Private sector developers will be looking narrowly for a return on their investment.

Some evaluations cast considerable doubt on the additionality of science parks. Do they create new jobs or simply corral those high-technology jobs that would have developed in the surrounding region anyway? Shearmur and Doloreux (2000) considered the relationship between high-tech employment change and the presence of parks in major urban areas in Canada. They concluded that the presence of a science park appeared to have had no effect on the rate of growth of high-technology industry in the surrounding city. Both high-tech employment and science parks tend to be associated with urban size: parks are demand-led and emerge in cities that are predisposed to receiving high-technology industry. Thus parks may have been successful due to the presence of demand for space from existing high-technology development, or have quietly failed due to the lack of demand. Any long-term analysis of science parks in the United Kingdom reveals a number in older industrial cities that have been absorbed by neighbouring universities or converted into generic business and office space, whilst some of the more successful ones have been located in local economies that were booming before the formation of the park (Surrey is a good example).

The evidence on the impact of science parks on firm location is also ambiguous and varies internationally. In the case of Sweden, Löfsten and Lindelöf (2002) found that for new technology-based firms (NTBFs), those based in science parks had a higher rate of employment and sales growth than comparative NTBFs which were not located in parks. There was, however, no clear relationship with firm profitability. Science park firms were also more likely to have links with universities. In Chinese Taipei, Yang *et al.* (2009) reported that NTBFs in Hsinchu Science Park were more efficient at investing in R&D and yielding greater outputs, although this could be due to the selection processes of firms locating in the park. In the United Kingdom, there have been a number of studies comparing science park firms with matched samples of off-park firms, with mixed results. Westhead and Storey (1994) have conducted a series of studies of matched samples and have found little difference in performance, and survival rate between science park and non-science park firms. Westhead (1997) also looked at R&D inputs and outputs and whilst science park firms tended to be a little more R&D intensive than non-science park firms, again the differences were not significant.

Few studies examine the impact of science parks on universities. Link and Scott (2003). found that US universities within science parks experienced benefits in the form of increased publications and patents, greater extramural research funding and an enhanced ability to hire high quality academic staff and to place doctoral graduates into employment.

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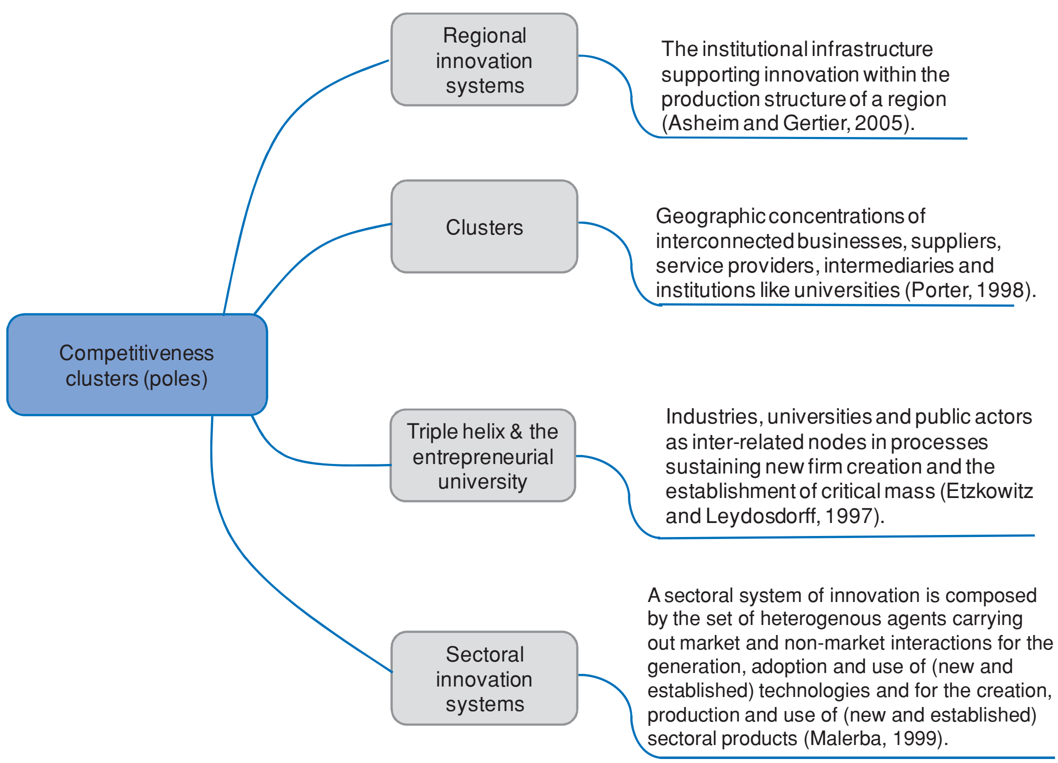
## 6.2. Systemic initiatives: clusters, networks, competitiveness poles and competence centres

### *Definition, rationale and objectives*

A broad literature and empirical research on innovation systems provide a theoretical and conceptual under-pinning for a wide array of "systemic initiatives", policies promoting partnerships for innovation involving several interacting actors. These take various forms and appear under different labels, notably: clusters, networks, competitiveness poles and competence centres. The cluster concept has received considerable policy attention since the seminal work of Porter in the 1990s, while the competitiveness pole concept has more recently moved to the top of policy agendas. Figure 6.1 summarises four main strands of research that contribute to the rationale behind this type of systemic policy.

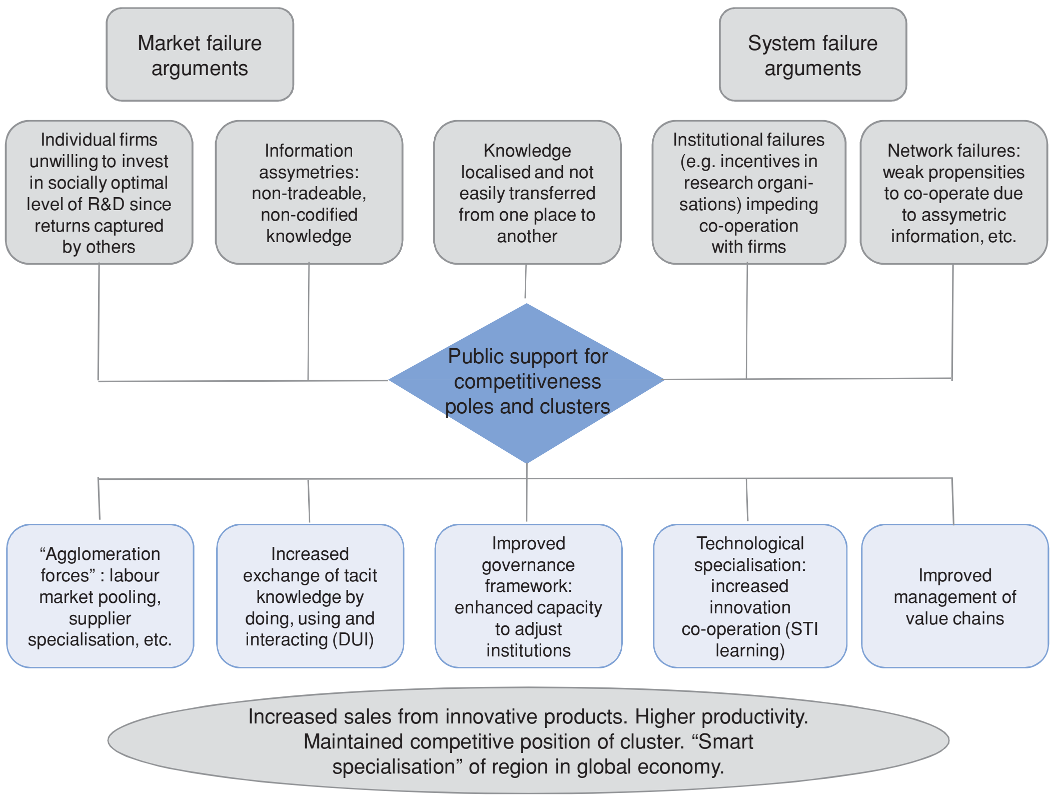
Figure 6.1. **Theoretical underpinning of competitiveness poles and clusters**




*Source:* Technopolis (2010), "Review of Innovation Policy Instruments", background paper for the OECD.

The traditional market failure justification for government intervention in favour of R&D and innovation has been complemented by the innovation system theory. This newer justification underlines the importance of interactions between agents and of policy tackling bottlenecks, or system failures, in innovation systems. It therefore goes beyond addressing isolated innovation events through subsidies to single agents (companies, etc.). A systemic approach emphasises the importance of the microeconomic business environment and of linking business, universities/research and public actors in what has been called a "triple helix" of innovation. Hence competitiveness poles are justified both on the basis of market and system failures arguments (see Figure 6.2).

Figure 6.2. **Intervention logic for competitiveness poles and clusters**




*Source:* Technopolis (2010), "Review of Innovation Policy Instruments", background paper for the OECD.

The literature underpinning the logic of intervention for competitiveness poles, clusters, networks and competence centres, highlights a range of potential effects. They range from agglomeration forces through improved knowledge exchange to technological ("smart") specialisation and improved management of value chains. The literature has increasingly underlined that policies that focus exclusively on strengthening regional linkages are not optimal and it is important that involvement in such initiatives encourage firms to connect "regional buzz" to national and international networks by encouraging the growth of national and international pipelines. One of the arguments for linking up regional business people with their academic counterparts is that the latter are often active in international research networks and can act as bridges to a broader knowledge base.

Finally, the intervention logic and types of effects of clusters and competitiveness poles policies differ according to the three main target groups (see Table 6.3).

Table 6.3. **Target groups of clusters and competitiveness poles**

| Target | Logic of intervention | Types of effects |
|---|---|---|
| Universities<br>(& public research centres) | Removing barriers and facilitating university researchers to interact more with regional SMEs in joint research and co-development in specific technology fields<br>Developing internal capabilities to act more as entrepreneurial universities | Increased revenue from licensing or equity returns from stakes in spin-offs/joint ventures<br>Increased number of doctoral/post-graduate students involved in industrial research with regional SMEs<br>Improved interaction with regional firms on higher education curricula |
| Large firms | Encouraging larger firms to embed their innovation activities regionally by joint R&D with SMEs or universities | Increased regional business expenditure on R&D<br>Enhanced process of open innovation with resultant circulation of tacit knowledge |
| SMEs | Overcoming barriers due to internal capability limitations or external constraints (e.g. financing) to smaller firms undertaking innovation | Increased regional business enterprise expenditure on R&D (BERD)<br>Upgrading of SME capacity to undertake innovation over the long term |

*Source:* Technopolis (2010), "Review of Innovation Policy Instruments", background paper for the OECD.

### *Clusters and networks*

Because of its relevance for innovation systems and its popularity, due to flagship successes like Silicon Valley or Route 128 in Boston, the cluster concept has gained a prominent place in regional innovation policies. Porter's seminal work defines clusters as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities". They include suppliers of specialised inputs, customers, manufacturers of complementary products and related firms, as well as governments and other institutions (for example, universities, standards agencies, and trade associations). There exists debate about the definitions and use of the cluster concept, and many different phenomena have been considered under the cluster label, creating confusion. According to Nauwelaers (2003) the core elements of the cluster are:

- **geographical concentration:** this is at the heart of the idea of clusters, though a number of approaches consider the case of "virtual clusters" of firms spread over a large territory, thus lacking geographic proximity. Arguably, the new possibilities offered by information technology solutions can in part overcome the distance, but overall, the "death of geography" proponents have not succeeded to explain the persistence of physical agglomerations of firms;
- **specialisation:** alleged cluster benefits (see below) are only likely to occur if firms are linked by a common orientation towards closely-related technologies, markets or processes. This specialisation usually spans across several industries. If such commonalities are not present, then the agglomeration reflects other phenomena, such as metropolitan attraction or general environment conditions (e.g. the presence of communications infrastructure). The word cluster is sometimes also used for purely geographic concentrations of unrelated actors;
- **presence of companies together with other institutions:** the cluster concept is broader than that of industry, not only because the field of activity is usually defined across traditional sector boundaries, but also because it includes organisations of

another nature. Organisations such as training and research institutions, regulatory institutions, public bodies, intermediaries, financing institutions, etc. are also part of clusters. The appeal of the cluster concept is that it reflects an innovation systems view, in which framework conditions and non-firm actors play an important role in business activities. Some cluster concepts with an exclusive focus on firms from the same industry are, however, also used;

- **connectivity:** the cluster concept incorporates a main idea of the regional innovation system approach, inter-relations among actors as an essential component. This criterion is not always found in actual clusters, some of which consist of firms grouped under specific areas of activity, but lacking the depth of linkages and inter-relationships that are necessary for seizing cluster benefits;
- **structural character:** cluster as a mode of organisation for production (long-term) differs from temporary groupings of firms, around specific projects (short-term). In reality, both types of phenomena are observed under the heading of clusters: structural as well as temporary linkages, the latter being closer to "projects" than to the cluster idea;
- **critical mass:** clusters should include actors which, together, have a certain weight in their economy. Reality shows that this is not a necessary element in a number of policy approaches, e.g. where emerging clusters are detected or small SME networks are put under this label; and
- **importance of innovation:** clusters as a phenomenon do present an interest if they focus on innovation. Innovation is understood in a wide sense, encompassing not only technological, but also organisational or commercial aspects, with an accent on successful (in economic terms) new combinations of technologies and ideas.

A distinction can be drawn between networks and clusters. A regional network is an "organisational arrangement among distinct but related small and medium-sized for-profit organisations […] characterised by complex reciprocal, co-operative rather than competitive, and relatively stable relations between independent though economically interdependent firms" (Sydow, 1996). Business networks do not necessarily have to operate in related industries or be geographically close. Boekholt and Thuriaux (1999) consider that networks and clusters differ in that networks are a group of firms with restricted membership, whereas membership of a cluster is not necessarily formal. Networks can be (and often are) part of a broader cluster, but this is not always the case. Furthermore, one of the key features of cluster policies is the promotion of networks as a tool to foster cluster development.

Cluster initiatives have flourished in an attempt to replicate success stories and stimulate emerging clusters. Cluster support policies vary along many dimensions, notably the targets of policies, the instruments used, the focus level of cluster maturity, the role of regional authorities, etc. (see Table 6.4). A range of the different policies can be grouped under the generic label of cluster policies. Nauwelaers and Wintjes (2008) classify them under three broad types:

Table 6.4. **Characteristics of cluster policies**

| Dimension | Possible characteristics | Source references |
|---|---|---|
| Cluster policy model | Policy programmes<br>Policies influencing the framework conditions for specific clusters<br>Strategic action for clusters. | Andersson *et al.* (2004); Boekholt and Thuriaux (1999); Borrás and Tsagdis (2008) |
| Parent policy | Clusters may be more or less influenced by the following policy streams:<br>-industrial policy;<br>-regional policy;<br>-technology policy | Boekholt and Thuriaux (1999); Nauwelaers (2003) |
| Interpretation of cluster | Broad interpretation of clusters<br>Narrow industrial district<br>New clusters *vs.* existing clusters | Martin and Sunley (2003); Henry and Pinch (2006); Borrás and Tsagdis (2008) |
| Cluster initiative | Clusters may be:<br>-government-driven efforts to foster clustering (top-down)<br>-instigated, funded and governed primarily by private actors (bottom-up). | Fromhold-Eisebith and Eisebith (2005);<br>Sölvell *et al.* (2003) |
| Targets | Clusters may target:<br>-small *vs.* large firms within clusters<br>-core regions, less favoured regions, all regions<br>-leading *vs.* restructuring sectors | OECD (2007) |
| Cluster identification and selection | Top-down *vs.* bottom-up<br>Quantitative *vs.* qualitative methods<br>Competitive *vs.* non-competitive | OECD (2007); Nesta *et al.* (2003); Roelandt and den Hertog (1999) |
| Instruments | Cluster policies may use a variety of instruments such as:<br>-actors engagement<br>-collective services<br>-collaborative research | OECD (2007); Nauwelaers and Wintjes (2008);<br>Andersson (2004); Landabaso and Rosenfeld (2009) |
| Cluster organisations | Non-profit associations<br>University representatives or local government<br>Consortium or mix of public and private actors | OECD (2007); Isaksen and Hauge (2002); Landabaso and Rosenfeld (2009) |
| Resourcing and timing | Engagement of actors with modest budget typically for 3 years<br>Substantial collective services over longer period and up to 1 million budget<br>Heavy R&D investment for longer period<br>Possibility to mobilise additional matching funds | OECD (2007) |

*Source:* Charles, D. and E. Uyarra (2010), "Practical Benefits of Innovation-related Policy Instruments at the Regional and Local Level", background paper for the OECD.

1. **Acting on the cluster environment:** this category gathers the heavier public support for clusters, in terms of visibility and intensity of policy efforts. The first variant of such policy, "cluster-informed" policies, refers to the combination of a large number of policy instruments, in a co-ordinated fashion and adjusted to the specific needs of the cluster. A second variant is the provision of co-operative research-industry platforms acting as nodes of knowledge-based clusters.

2. **Facilitating synergies:** this category includes lighter policy intervention in clusters, reflecting the idea of some governments that policy intervention should be limited to providing impulses and playing a catalytic role, rather than being a driver or putting important resources in the clusters. This facilitating role can be played either on a territorial basis (regional/local initiatives) or more directly at the level of clusters, where the support targets the formation of the cluster identity and plans.

3. **Supporting projects:** cluster policies may also take the more operational form of collective projects support (in this case public support might be either heavy or light,

depending on the nature of the projects). Two types of such projects can be distinguished, according to the fact that they address a range of activities (marketing, export, production facilities, demonstration, etc.) or focus on technology and R&D development.

Cluster policies, including those that promote cluster initiatives, may have different goals.

- **Industrial restructuring and diversification** examples include the Basque Country, Spain (begun in the mid-1990s) or the West Midlands, United Kingdom (see Box 6.2). In Quebec, the competitiveness clusters policy started in the 1990s to restructure the economic activity, characterised by declining productivity growth and rising unemployment. Currently, the Montreal area has 15 identified competitiveness clusters in key sectors of the regional economy.
- **High-tech development** with a focus on research commercialisation is another approach, such as the Swedish-Danish biotech clusters or the Japanese Knowledge Cluster Initiative. The latter is a research-driven programme organised around local initiatives led by universities or public research centres (see Box 6.3); and
- Broadly supporting **competitiveness in more traditional sectors**. In Mexico, the state-initiated cluster programmes have been an instrument for industrial and production development policy. Examples include the case of the footwear cluster in the state of Guanajuato or the electronics industry in the state of Jalisco (Peres and Primi, 2009). These programmes support technology upgrades, infrastructure, favourable conditions for foreign direct investment (FDI), simplification of regulations for the establishment of firms, incentives for collaborations between different agents, and supply chains around a multi-national enterprise.

### Box 6.2. **Business clusters in the West Midlands (United Kingdom)**

The regional clustering programme in the West Midlands was developed as a tool for achieving the West Midlands Economic Strategy (WMES), aimed at developing markets and sectors with the most wealth and employment potential. Starting in 2005, the region implemented the second cluster three-year programme through *Advantage West Midlands*, the regional development agency for the region. There are currently 12 business clusters in the region: aerospace, automotive, building technologies, environmental technologies, food and drink, ICTs, interiors and lifestyle, medical technologies, rail, screen image and sound, specialist business and professional services, and tourism and leisure. An analysis of the first programme 2005-2008 showed a significant increase in business confidence in the sectors where collaboration occurred, as well as the creation of informal and formal networks (linkages with university departments and other network organisations that have direct access to sectors and markets).

In the second stage, the programme focuses more on specific markets where the region has strengths and sustained market share over the long term. Each cluster has plans for the period 2008-2011 in which specific markets are targeted with the objective of delivering critical mass and investment through specific actions. These are exploited by market focus groups, which provide a forum for clusters to collaborate in a number of market opportunities. Each cluster launches individual proposals to develop and implement some of the projects outlined in their cluster plans.

*Source*: Advantage West Midlands (2008), *Summary Cluster Plans 2008-11*, *www.advantagewm.co.uk/Images/SUMMARY%20ALL%20CLUSTER%20PLANS%20-%20Final%20-%20for%20publication%2014%20March%2008.doc_tcm9-16192.pdf.*

### Box 6.3. **The Knowledge Cluster Initiative for Japanese regions**

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan has been implementing the Knowledge Cluster Initiative since 2002 with the objective of boosting regional economies. The Second and Third Science and Technology Basic Plans of 2001 and 2006 called for the creation of knowledge clusters and the support of regions that had the potential to develop world-class knowledge clusters.

The initiative promotes joint research conducted by industry, academia and government at university joint research centres to produce new technologies in light of corporate needs. It gives a strong emphasis on the patenting of research results, by fully implementing projects from R&D to commercialisation of research outputs.

The Knowledge Cluster Initiative is divided in two programmes: Innovative Stage and 2nd Stage. Six Japanese regions are part of the Innovative Stage Programme, and nine are part of the 2nd Stage, in knowledge clusters around green materials, life sciences, health and medicine, marine biology industries, nanotechnology, environment, and materials. Local universities have a directive role, and they set the minimum amount of expenditure by local actors.

The 2nd Stage Programme includes a sub-programme named the "Expansion Programme", which encourages collaboration with other regions in Japan and abroad. An example of international collaboration in the Fukuoka Kitakyushu Iizuka region is the Fukuoka Cluster for Advanced System LSI Technology Development, which built collaboration networks in the Silicon Sea Belt, and the research achievements have been expanded through research collaborations with universities in Chinese Taipei and Shanghai as well as with business associations in Bangladesh.

The Knowledge Cluster Initiative is complementary to the Industrial Cluster programme promoted by the Ministry of Economy, Trade and Industry (METI). The achievements of MEXT policies have been applied and commercialised by METI, which has resulted in feedback of market needs and has led to new R&D.

*Source*: Ministry of Education, Culture, Sports, Science and Technology of Japan (2009), *The Knowledge Cluster Initiative*, brochure, *www.mext.go.jp/a_menu/kagaku/chiiki/cluster/1288448.htm.*

Since the focus of cluster programmes is business-oriented, funding is usually a mix of public and private funds. For example, in the case of the Basque Country (Spain), the enterprises that join the cluster associations also finance its functioning. The private sector finances 40% of the internal costs of the association and 50% of the external costs. The balance is financed through public funds by the cluster policy and related policies of the Basque government. In Montreal, R&D collaborative projects are financed at least 25% by the private sector, while the rest is financed by public funds assigned to universities. Management and co-ordination costs are financed on a basis of 58% by the public sector and 42% by the private sector. The Japanese Knowledge Cluster programme has a two-step funding scheme, with flexible budget allocations to regions in a first stage according to their R&D field and their degree of progress. In a second stage, budgets are promoted through flexible contracts with other organisations, such as science and technology foundations designated by local governments.

### *Competitiveness poles and competence centres*

Competitiveness poles and competence centres are both systemic initiatives that differ from cluster initiatives. The latter are normally more business focused with an emphasis on support for exports, inter-enterprise co-operation, quality, promotion of business expenditures in R&D, etc. In contrast, competitiveness poles are large and broad partnerships of industrial, public and academic research organisations located in a distinct region (occasionally inter-regional or cross-border). The best-known examples are the French competitiveness poles but a number of other countries or regions have also developed similar approaches including Wallonia (Belgium), Greece and Hungary. Competence centre programmes are organised as research, technology, development and innovation (RTDI) collaborations in strategic areas between academia and industry, and in some cases include public bodies. They comprise specialised smaller groupings of enterprises (notably SMEs) collaborating with one or more research teams in universities. Examples can be found in Estonia, Sweden and Northern Ireland. There is a large diversity of implementation forms and instruments within these two models. Table 6.5 summarises the different forms for each model.

Table 6.5. **Implementation forms of competitiveness pole models and competence centres**

<table>
<tr><th>Models</th><th colspan="4">Implementation forms</th></tr>
<tr><td rowspan="3">Competitiveness poles</td><td>Industry-driven</td><td colspan="2">R&D-driven</td><td>Collaboration-driven</td></tr>
<tr><td>Large presence of big international groups investing massively in R&D<br>Fundamental research outsourced to SMEs<br>Integrated and local financing system<br>International scope based on the capital of large industrial groups</td><td colspan="2">Strong and dynamic entrepreneurial activity<br>Low-risk environment for high-risk projects<br>Attractiveness of universities by R&D centres of international industrial groups<br>Potential for the development of technology parks through a model “industry on campus”<br>International scope based on universities and R&D centres</td><td>Intensive collaboration between public and private sectors; very active role of public sector<br>Strong entrepreneurship supported by investment funds of large industrial groups<br>International scope based on the collective dynamics of system of actors</td></tr>
<tr><td>Examples: BioValley Bassel (Switzerland); CARS in Stuttgart (Germany)</td><td colspan="2">Examples: Cambridge Silicon Fen (United Kingdom);<br>Tel Aviv (Israel)</td><td>Examples: Medicon Valley (Denmark and Sweden);<br>Silicon Saxony (Germany)</td></tr>
<tr><td rowspan="3">Competence centre programmes</td><td colspan="2">University driven/owned</td><td colspan="2">Public-private partnerships (PPP) or business sector driven</td></tr>
<tr><td colspan="2">The aim is to develop (academic) knowledge production<br>Based on arguments on of the entrepreneurial university and the triple-helix<br>Usually integrated in a university</td><td colspan="2">Oriented towards valorisation through technology transfer and more applied science<br>Programmes are led by industry that empower researchers and research institutes to develop strategic R&D for the benefit of industry<br>They are normally created as distinct and independent legal entities</td></tr>
<tr><td colspan="2">Examples: Austria, Sweden, Basque Country (Spain)</td><td colspan="2">Examples: Estonia, Northern Ireland (UK), Valencia (Spain), Flanders (Belgium)</td></tr>
</table>

*Sources:* DGCIS (2009), “Étude sur les bonnes pratiques de dix pôles de compétitivité étrangers”, République Française, final report of the study carried out for the Direction générale de la Compétitivité, de l’Industrie et des Services (DGCIS) by Algoé, May; Insogna, K., H. Wilhelm and C. Borek (2010), “Research Driven Clusters: Overview of RDC Policies, Methods and Characterization and Example of Best Practices”, Trans Reg NCP Project; COMPERA (2010), “International Co-operation of Competence Research Centres”, final report of the COMPERA joint study, Agency for Innovation by Science and Technology, by P. Boekholt, J. van Til, E. Arnold, T. Jansson, R. Rannala, M. Ruiz Yaniz and B. Tiefenthaler, June.

### Competitiveness poles

Competitiveness poles were developed as a systemic approach to industrial policy for competitiveness to respond to challenges brought about by globalisation. The keywords that best describe competitiveness poles are global networks, attractiveness and governance. They gather firms, research organisations, training institutes, specialist management services, and other expert support services, around specialised activities in order to foster knowledge-oriented regional development. Enterprises are not organised only to innovate, but are rather co-ordinated with each other, have strategic synergies and partnerships to achieve global excellence. Public bodies (national, regional, and local) are normally associated to the poles, and provide services to its members. The partnership is organised around a market and related technology, seeking to build a critical mass to be competitive and have international visibility.

One study identified three determinants of world-class competitiveness poles (DGCIS, 2009):

- Competitiveness poles not only include the three key actors of the knowledge triangle (enterprises, research centres and training centres), but also a strong network of investors and consultants, and local and national public bodies that foster collaborations inside the pole.
- They are territorially anchored, a geographic concentration of actors, whose governance structures are based on the local industrial system that determines the co-ordination of the pole thanks to permanent human and financial resources.
- Collaboration between public and private actors facilitates the creation of enterprises and start-ups that contribute to the diffusion of innovation inside the pole, and are also the origin of employment growth.

In the EU, the most common example originates from the French concept of technopole, born in the 1970s following the Japanese and American examples. National policies in support of competitiveness poles in France began in 2005, following two strategic reports that gave increasing importance to the role of regions in the move towards an innovative and competitive economy. The current French national policy on competitiveness poles, Competitiveness Clusters Policy 2.0, is the second phase of the competitiveness cluster policy that covers the period 2009-2011, following the first phase launched in 2005. Since then, regions in France, following certification processes in 2005 and 2007, have implemented regional policies in support of their certified competitiveness poles.

The region of Brittany in France is one of the regions that had embedded the French national policy in support of poles in its regional policy in support of RTDI. In 2008, the competitiveness poles included more than 1 000 partners and 627 organisations (mostly research centres and SMEs) in 246 certified collaborative projects. 203 of these projects were co-financed with public funds, representing about EUR 153 million of a total of EUR 465 million invested. The policy, managed by the regional council, represented about 22% (EUR 10.8 million) of all R&D credits through collaborative projects in the region. The growth in membership of the poles was mainly due to SMEs, which represented about 57% of all new members between 2005 and 2008. An external evaluation of the regional policy in 2008 showed mixed results related to the integration of regional actors from pole to pole. In all cases, public research laboratories were central in pushing for collaborative projects. They gained in terms of financing, in reinforcement of their research capacity, and regional notoriety. The evaluation also showed that SMEs are the least prepared in participating in research projects, mainly because of administrative burdens and lack of capacity. The national government has extended the certification of all four competitiveness poles in Brittany for the period 2009-2011.

The Wallonia Region in Belgium has also implemented a competitiveness poles policy that complements the clusters approach developed in the region since 2000 (Box 6.4). It is the response of the regional government to the business structure in the region, characterised by a small number of large enterprises and a large number of SMEs with limited R&D capacities. The aim of the regional competitiveness poles policy is to create greater critical mass in the Walloon innovation system by federating different efforts in specific industrial sectors. The strategy is oriented towards connecting all relevant actors, developing new infrastructure, and creating more value from R&D projects.

### Box 6.4. **Competitiveness poles and Wallonia (Belgium) STI policy**

Since 2005, the competitiveness poles are a major component of the Walloon STI policy with a budget from 2006-2010 of EUR 280 million. The measure is one of the five priorities of the Marshall Plan and is a major shift in the regional policy both in terms of the financial means mobilised as well as the process of design and implementation. Five sectors and corresponding poles were identified and officially recognised by the regional authorities: life sciences (Biowin); agro-food (Wagralim); mechanical engineering (Mécatech); transport-logistics (logistics in Wallonia); and aeronautics/space (Skywin). With the recent Marshall Plan 2.Green adopted in 2009 (2009-2014), a 6$^{th}$ competitiveness pole focusing on environmental technologies was launched.

Each competitiveness pole has received funds to implement strategic actions. All funding is granted on the basis of calls for projects, which invited proposals including a mix of research projects and planning linking the research to an overall pole strategy. The support from regional government can take different forms: investments in infrastructure, buildings and equipment (EUR 50 million); R&D funding (EUR 120 million); investment grants (EUR 45 million); training support (EUR 55 million); attracting foreign investments (EUR 4.5 million); and export promotion (EUR 5.5 million). In 2008, an extra EUR 42 million was granted for financing projects related to sustainable development and energy efficiency. The participants of the poles retain, in addition, access to all existing forms of support for investment, R&D, employment measures, training and exports according to normal procedure for proposals presented outside of the cluster framework. Proposals presented within the framework of the cluster such as projects included in the business plan or subsequent work programmes for spin-offs, qualify for maximum aid and a specific top-up for some of the measures.

The private sector has a key role in steering the competitiveness clusters in partnership with the French-speaking universities, which have the right to appoint a deputy chairperson to the board of each cluster. Regular calls for projects for the members of the poles are organised by the regional government. Between 2005 and 2008, 55 research projects following 4 calls for projects were approved.

*Sources*: Bayenet B., M. Wunderle (2009), "Les pôles de compétitivité wallons", courrier hebdomadaire CRISP, N°. 2030, CRISP; Belgian Science Policy Office/BELSPO (2010), *Belgian Report on Science, Technology and Innovation*, June.

There are several common forms of financial support provided to competitiveness poles, in some cases with substantial public funding that also leverages private investment. Funds are used for: investments in infrastructure (buildings and equipment); R&D projects; investment grants; R&D credits through collaborative projects (financed partially by the private sector or through university funds); training support; support for attracting foreign investments; and export promotion. Public budgets vary, such as EUR 280 million (2006-2010) in Wallonia and EUR 153 million in Brittany (2005-2008). The origin of funding depends on the regional institutional structures and the strategic approach of the policies. The source of funding in Wallonia is regional authorities. In the case of Brittany, it is a mix of regional and EU policy funds. Other sources of funding (i.e. non public) represented about 70% of all investments in the case of Brittany.

## Competence centres

Competence centre programmes are organised as RTDI collaborations in strategic areas between academia and industry, strengthening regional innovation systems. Their aim is to achieve stronger impact and concentration of research efforts by creating research environments in which enterprises can participate actively and benefit from the results. Centres therefore play an important role in innovation networks and clusters. Competence centre programmes are also characterised as public-private partnerships (PPP). Their activities usually include the pooling of knowledge, the creation of new knowledge by performing research, training, and the dissemination of knowledge. Some programmes (i.e. Northern Ireland, United Kingdom) are led by industry, which empower highly qualified researchers in research institutes and universities to develop strategic R&D for the benefit of industry. Competence centre programmes activate industrial participation in formulating strategic goals and implementing academic research. They also enhance the research profile of the involved universities, and strengthen long-term research collaboration networks.

This type of programme became popular in the early 1990s. Sweden, through the former NUTEK (known at the time as the Swedish National Board for Industrial and Technical Development) developed a Competence Centre Programme. More recently, Estonia has also developed a programme (see Box 6.5). There are two implementation models: those that are created as distinct and independent legal entities, and those that are integrated in a university.

Centres can take both physical and virtual forms. The physical form is a centralised centre where research is carried out in one or more specific locations (i.e. Valencia in Spain, Sweden). In the virtual model, research is conducted across various locations, most often in the research sites of one of the participants (i.e. Germany, Flanders in Belgium) (COMPERA, 2010).

Financial support is typically given in the form of grants or subsidies, generally with public and private co-financing. Selection is determined through calls for projects and proposals addressed to universities, institutes of technology and research groups within academic institutions. Support can also take the form of open competitions, and in some cases planning grants are also funded for pre-selected projects. In the EU, the average annual research budget of a competence centres is around EUR 7.9 million, from which 76% is public and 24% private (from industry and research institutes) (COMPERA, 2010).

### Box 6.5. **The Competence Centre Programme in Estonia**

The Competence Centre Programme in Estonia was among the measures introduced to improve the performance of the Estonian innovation system in the run-up to EU membership. It was then integrated into a package of measures funded by the European Regional Development Fund (ERDF). Five competence centres for three years were funded, initially by national funds and later with ERDF co-funding. The programme tackles weaknesses in the Estonian innovation system, notably its low R&D capability. Its aim is to create technological strength in research and human capital so as to position Estonian industry to become technologically more competitive. Through Enterprise Estonia, the Estonian government and the ERDF provide subsidies to the competence centres with a final public contribution of 75%.

A mid-term evaluation in 2008 showed significant success. Three of the five funded centres managed to increase their industrial income significantly above expectations. The programme is highly decentralised and allows the centres great flexibility in the way they spend their budgets. Some centres had chosen to build up a committed core team, while others had maintained a slim core and a fragmented periphery of researchers. The programme has served to focus research attention and effort on specific areas of technology. It has also provided human resources to strengthen university and industrial systems. By 2008, the centres' aggregate publication and patent outputs were growing; however, they remain low in international comparison. In July 2008, a new call for proposals was launched for a seven-year successor programme.

*Source:* Ministry of Economic Affairs and Communications of the Republic of Estonia (2008), *www.eas.ee*.

The structure and funding sources vary by programme. In Sweden the competence centres are integrated in a university, and one of the selection criteria was that a number of industrial partners financially supported the activities of the centre. The Swedish model followed a stepwise funding and follow-up: during the first two years, funding came entirely from public funds; after two years, the programme covered up to SEK 6 million per year of total expenses of the centre, while the industrial partners contributed at least the same amount, including kind contributions. In the Estonian Competence Centre Programme, the centres were implemented as independent legal entities, and co-financed by the ERDF (although the programme was initially funded solely from national funding). The budget for the period 2007-2013 is EEK 1 billion (EUR 64 million), with an additional contribution from the project partners of between 30-35%.

### *Regional dimension*

The concept of clusters, which underpins the development of competitiveness poles and competence centres, became a target for local and regional initiatives in the 1990s following Michael Porter's *The Competitive Advantage of Nations.* The main argument was that firms and supporting organisations that operate in close proximity are often more competitive than isolated firms. The proximity and accompanying relationships facilitate the creation and dissemination of knowledge and skills through competition and co-operation. Co-operation can take the form of formal alliances, but enterprises also benefit from tacit knowledge exchanged among firms along the value chain, or through other forms of social interactions.

The regional dimension of competitiveness poles and public-private partnerships for innovation can be better understood using the concept of "untraded interdependencies" (Storper, 1997). When clustering occurs because of commonalities related to technological development, "untraded interdependencies" arise such as common coded language, norms, customs and practices. These common institutions facilitate trust and co-operation. Implicit is also the idea that there are ongoing interactions between key players in a spatially defined area. This phenomenon also addresses the incremental nature of innovation at the regional level, where each idea builds upon previous ideas, and thus every exchange contributes to a common knowledge base that can be the source of unique advantages to firms and other support institutions taking part in a cluster or competitiveness pole. Agglomeration economies occur when there is a positive cumulative effect to several companies being located in the same place. Clusters and poles aim at identifying and stimulating these positive effects, a justification for action by regional authorities. Cluster programmes and competence centre programmes have a strong regional and localised dimension. Competitiveness poles are more global in perspective and respond to the characteristics of global industries and value chains.

In policies geared towards SME networking, the local and regional level is considered the most appropriate level for policy design and implementation. Authorities at sub-national level are more aware of the problems of the locality and are allegedly better placed to adapt policies to specific regional circumstances. This may especially be the case for those policies aimed at helping SMEs grasp opportunities for collaboration and access strategic knowledge (Boekholt and Thuriaux, 1999).

These systemic initiatives may occur at different levels depending on the country context and regional competences. Generally, in federal states or more decentralised countries (such as Belgium, Spain or the United States), cluster policy is developed and implemented at the regional level, and therefore objectives, goals and instruments are often very different from one region to the other. In Canada, however, even though sub-national governments have implemented strategies to support clusters, the main programme with an explicit cluster strategy is delivered at the national level by Canada's National Research Council (NRC). In the United States, the policy instruments and resources to promote clusters and economic development are generally the realm of state policy but are recently recognised at federal level. The rationale for the choice of level of programme responsibility depends on issues such as: financial resources (availability, redistribution issues), knowledge of actors in the regional innovation and their relationships, technical capacity, the spatial dimension of regional innovation actors, the nature of spillovers, and the institutional frameworks supporting clusters (OECD, 2007).

Different forms of inter-governmental co-ordination may also enable a greater impact of these policies. The combination of different instruments from different strands of policies has led many cluster programmes to set up mechanisms to facilitate co-ordination at the top, for instance in Finland, France, Norway, Sweden and the United States, through inter-ministerial or inter-agency committees. National/regional co-ordination is particularly crucial in federal and regionalised countries. The BioRegio and InnoRegio programme in Germany, and the NRC technology cluster programme initiatives in Canada, are examples of successful joint work between the federal and the regional level, with the former playing the role of facilitator and the latter actively managing the programmes.

### *Evolution over time and variety*

Systemic policies supporting networks, clusters, poles and competence centres, have evolved considerably over time. Marshall's concept of industrial districts, where geographically concentrated clusters can be explained by specialised labour, specialised intermediate inputs and knowledge spillovers, was the initial approach. Since then, regional cluster policy has evolved using concepts such as learning regions, innovative *milieux* and regional innovation systems, which stress learning as a key factor or regional competitiveness. Policy interventions have shifted from simply influencing the inputs of business activity to be more focused on the supporting the co-operation between industries and knowledge generators that underpins competitiveness.

In Italy, cluster and network initiatives were launched in the 1970s and 1980s. Denmark was also an early adopter with its Industrial Network Co-operation Programme launched in 1989. The programme served as a basis for others in Australia and the United States (Technopolis, 2003). The Dutch and Finnish governments pioneered brokering programmes with strong SME components. Austria, Canada, Finland, France, Germany, New Zealand, Norway, Spain, Portugal and the United Kingdom are also countries that began supporting human capital and innovation issues connected to clustering (Isaksen and Hauge 2002).

The number of cluster initiatives has grown substantially in recent years. Well-known examples in the EU are the furniture clusters in Northern Italy, shoe making in the Veneto region, ceramics in Emilia-Romagna, and the automobile sector clusters in the Austrian regions of Styria and Upper Austria. There has been a big boost more recently with public-private partnerships for innovation, and an upsurge in cluster initiatives. In the United Kingdom, clusters were endorsed in the late 1990s, together with a national cluster mapping exercise, and were promoted as key element in the regional economic strategies of the newly created regional development agencies. The Green Book on cluster initiatives identified more than 500 cluster initiatives around the world, primarily in Europe, North America, New Zealand and Australia (Sölvell *et al.*, 2003). This upsurge has not been linear. In some countries initial enthusiasm has subsided, such as in the United Kingdom.

In 2008, the launch of the European Cluster Memorandum marked an important step towards encouraging cluster development at EU level, building on the efforts of individual member countries. Other complementary EU initiatives include the High-Level European Cluster Policy Group, the European Innovation Platforms for Clusters (Cluster-IP), the European Cluster Alliance, the European Cluster Excellence Initiative, and the European Cluster Observatory. Based on the information contained in the ERAWATCH-INNO-Policy TrendChart database, there are more than 130 specific national measures supporting framework cluster policies across 31 European countries (Stahlecker *et al.*, 2010). Almost all EU member countries have developed cluster-specific measures or cluster programmes at the national and regional level.

In the last year, the US federal government has begun using cluster approaches in policies of several departments and agencies. A federal task force on regional innovation clusters has been created to co-ordinate across such entities as the Departments of Commerce, Energy, Agriculture and Labour among others. The E-RIC programme designated a leading regional innovation cluster for development of energy efficient building systems. The Economic Development Administration (Department of Commerce) has launched a cluster mapping exercise. US states have had a longer, but still recent, use of cluster approaches. A review of existing cluster programmes shows that most of the initiatives have been created since 2000 (Brookings, 2008).

The objectives of cluster policies have followed some general trends over time although all forms continue to co-exist with new elements. Three key trends observed in national cluster policies include: *i)* a change from smaller scale initiatives to promote SME networks to broader, more growth-oriented programmes for national competitiveness; *ii)* an increasing focus on innovation both in the orientation of policies and the prioritisation of innovation related instruments; and *iii)* changes in the objectives and instruments over time. Policy responses have tended to change as economic needs have evolved, lessons have been learnt from previous policies or even as new concepts have become fashionable (OECD, 2007).

Competitiveness poles policies are very recent, most developed in France from the mid-2000s and quickly replicated in countries ranging from Belgium (Wallonia Region), Greece ("regional innovation poles"), Hungary, etc. Equally, the competence centres type initiatives have become a popular tool across a number of EU countries, notably during the last decade (COMPERA, 2010).

### *Success conditions and impact*

Cluster policy evaluations are rare (Fromhold-Eisebith and Eisebith, 2008; Diez, 2002; Raines, 2003; Andersson *et al.*, 2004). Many cluster programmes do not include a formalised post-programme evaluation. Only a reduced number out of the total cluster programmes analysed by the OECD (2007) established a clear evaluation approach when designing the programme.

Cluster success is often measured by level of participation in cluster organisations. Participation and cluster membership size is indeed an indication of the level of engagement. However, membership lists do not define a cluster as lists do not indicate the level of participation and take up of services by member firms (Landabaso and Rosenfeld, 2009). Monitoring targets to measure outputs can be counterproductive if they only focus on number counting (number of firms enlisted, services received, number of meetings and events attended) as this can distort the behaviour of cluster implementers. Evaluations often focus solely on a single element, which contradicts the systemic notion of cluster policies (Andersson *et al.*, 2004).

Most surveys question cluster experts or managers (i.e. in charge of promoting the cluster) on the issue of policy relevance, and to a lesser extend the firms in the clusters. Borrás and Tsagidis (2008) surveyed cluster firms and institutions to identify the most relevant policy areas. The firms identified areas related to information diffusion, physical infrastructure, customised services, and education and training as the most important. Among the least relevant were: firm networks, venture/risk capital, start-up and incubation, and firm relocation. The survey thus revealed that most clusters present large or very large policy relevance gaps between firms and the institutions supporting them. Such misalignment can prevent clusters from achieving strategic goals, particularly for those clusters repositioning or declining.

In terms of time frame for financial support, Landabaso and Rosenfeld (2009) note that while the setting up of cluster initiatives has proven relatively easy, sustaining them over time has proven much more difficult without long-term support. Other authors note that since most cluster initiatives will only show benefits in the long term, they need to be funded on a stable financial basis (Lagendijk and Charles, 1999). Often programmes have too short timeframes to achieve their largely long-term goals, as level of funding and exit strategies are not consistent with the aims. Continuity in funding would be particularly relevant for those programmes with a strong R&D collaboration component, and would also require larger investment funding. The promotion of networking mechanism may require between three to five years. A period of less than three years is unlikely to yield the expected results. Nevertheless, if actors count on continuous support policies in the long-term for all forms of cluster support, this can generate a moral hazard problem which diminishes impact (OECD, 2007).

A number of potential pitfalls have been associated with cluster policies. Policies may be ineffective in achieving their expected goals, but they can also lead to adverse effects which may hamper sustainable growth in the long term. Common risks include poor targeting, inappropriate policies and lack of policy co-ordination, and insufficient adaptation of support to cluster needs over time. Clusters can lead to excessive specialisation, which may make regions more vulnerable to external shocks. Excessive specialisation of the cluster may lead to long-term lock-in if the cluster fails to upgrade its knowledge base or suffers from poor external connectivity. Sölvell *et al.* (2003) highlight the importance of global attractiveness, and global market reach as a key success criterion in cluster initiatives.

Policy makers often try to replicate ideal models that are considered to be successful elsewhere. But the "natural" birth of a cluster or competitiveness pole is usually based on historical circumstances, such as the availability of raw materials, specific knowledge in R&D organisations, and/or traditional know-how. The success in implementation of clusters or competitiveness poles also depends on pre-existing scientific and/or industrial strengths at the regional level. In short, initial endowments matter (McDonald *et al.*, 2007). And many governments suffer from a bias towards high-tech sectors in areas lacking the capabilities and conditions for such activities, seeking to create clusters from scratch (Boeckholt and Thuriaux, 1999). Clusters may be too "institutionally thin" to adequately support firms and fail to build sufficient trust to encourage network activities across members.

Early engagement with the private sector also leads to more effective strategies. Cluster managers may not be sufficiently trained and skilled or lack the business acumen to understand the competitiveness challenges facing firms. They may underestimate the risks and efforts involved for companies to engage in inter-firm networking (Boeckholt and Thuriaux, 1999). In order to ensure sufficient business engagement, Roelandt and den Hertog (1999) note that cluster policies should not be government driven but instead emerge from market-induced and market-led initiatives, with the government adopting a catalyst or brokering role rather than taking a direct lead.

Another pitfall is policy support failing to align instrument selection to cluster objectives. There is a danger of trying to support clusters with inappropriate policies, for instance focusing on science or R&D support, when the key deficiencies relate to weaknesses in conditions for entrepreneurship (Andersson, 2004). Roelandt and den Hertog (1999) caution against directly subsidising industries and instead recommend using indirect inducement. Targets and instruments would also need to evolve over time, to prevent moral hazard and to adapt to new and evolving cluster needs. Thus a cluster that is emerging *vis-à-vis* a mature one will have different needs (OECD, 2007). The survey conducted by Sölvell *et al.* (2003) concluded that disappointing performance is often the result of: lack of consensus; the absence of an explicitly formulated vision for the initiative; quantified targets; or a framework that is not adequately adapted to the cluster's own strengths. Insufficient resources are also a common source of low performance. Interestingly, the survey also revealed that those cluster initiatives that had brand-building as a key objective were more likely to fail.

Cluster policies tend to involve, and are even encouraged to use, a broad range of policy tools often from different policy domains. At the same time, other policies impact on clusters indirectly (education, competition, regulation, etc.). Thus OECD (2007) points out the need to ensure policy coherence across sectors and levels of government to avoid duplication, conflicting objectives and the fragmentation of resources. They highlight a series of missed opportunities in policy integration, for instance the common lack of integration between research centres and cluster programmes, between science and industrial parks with cluster programmes, and regional with national innovation systems. The direct and indirect interactions and potential tensions between instruments are not addressed. There is a tendency to neglect the highly complex multi-level, multi-actor and temporally distributed character of policy mixes influencing clusters, both in policy analysis and evaluation (Flanagan *et al.*, 2008; Borrás and Tsagadis, 2008).

Unlike cluster initiatives and other innovation policy instruments, competitiveness poles and competence centres have been more systematically evaluated (Box 6.6). A recent compilation of macro-economic benefits from success stories on those initiatives in the EU shows two types of benefits (IRE, 2008):

- those related to **knowledge spillovers**, including the creation of formal and informal linkages and networks between firms, research institutions, public agents and other local organisations; and
- those related to the increase in the **attractiveness of the hosting regions**, including productivity increases, competitiveness enhancement, and in the long-term, economic growth and employment.

External mid-term and final evaluations of regional poles programmes have shown some immediate impacts. They find increased participation of SMEs and re-orientation of university activities towards economically more relevant research as well as boosting industrial doctoral studies (Arnold *et al*., 2008). Impacts related to knowledge spillovers include increases in co-operation processes between research institutes and the private sector; increase of partnerships in the private sector (BELSPO, 2010); and improvement of the linkages between public and private research institutes and groups. Public research laboratories may benefit substantially (Conseil régional de Bretagne, 2008) and became central in pushing for collaborative projects between the public and private sectors. A typical impact is the adoption of a more strategic vision by the academic world directed towards industrial use of research results. The initiatives had also helped in orienting and informing other regional policies in support of enterprises and increased firm awareness of the existence of these policies (Aranguren, 2010). An external evaluation of Wallonia's competitiveness poles showed: SMEs reported having more local partnerships than before; academic and industrial actors learned to work together; and the academic world has started to adopt a vision directed more towards industrial use of research results. The French Competitiveness Poles programme, a prominent national policy initiative with regional contribution, has also been subject to evaluation (see Box 6.6).

### Box 6.6. **Evaluation of the French Competitiveness Poles**

In 2007-2008, an independent mid-term evaluation was conducted for the French Competitiveness Poles programme. The evaluation targeted both the policy itself and each pole individually. At the policy level, topics included: dedicated means; consistency with other public policies (R&D and innovation); selection process; financing support processes; policy management at national and local levels; synergy between actors; and first effects on local actors. In the evaluation of individual poles, the following points were taken into consideration: economic and international strategy; pole governance and animation; evolution of the pole's population; R&D projects and firm-public research-training synergy; territorial settlement; and network strengthening (including structural projects, SME integration and new enterprises creation, human resources training, and a green development approach). The evaluation results showed that 39 poles had fully reached the objectives of the policy, 19 poles have partially reached them but should devote more efforts in defining strategy and governance, and 13 poles would benefit from an in-depth restructuring.

Between 2005 and 2008, the number of new entries into competitiveness poles increased, and in particular of large firms and SMEs. Actors from public research were less numerous but usually served as project leaders. In addition, partnerships between poles and economic development actors had increased as well. The evaluation stressed that the competitiveness poles policy has triggered or accelerated a co-operation process on innovative projects in all industrial sectors. It also concluded that the competitiveness poles can provide an important boost to improve the links between public and private research and ultimately strengthen the French strategic position in the fields of research, development and innovation. On the basis of these results, the French government decided to launch a second phase of the competitiveness poles policy for a further three-year period (2009-2011) with a total budget of EUR 1.5 billion.

According to the data published by the Ministry for the Economy, Industry and Employment at the end of the first round of the programme, 71 competitiveness poles were supported divided into 3 types: 7 global (word class) competitiveness poles, 10 globally oriented competitiveness poles, and 54 regional competitiveness poles. In the original version of the policy, only 15 competitiveness poles were to be selected. Despite the fear that public funding would be spread too thinly among the 71 poles, data show that funding focuses on the top poles. Approximately 80% of the EUR 36 million in grants for pole functioning costs have been attributed to world-class poles. Poles cover various thematic areas such as aeronautics, ICTs, life sciences and other traditional sectors such as wood, construction and finance. In 2007, 5 000 firms were pole members, 80% of which were SMEs. Around 738 R&D projects with 14 000 researchers have received EUR 946 million in public funding since 2005; 54% of funding goes to cluster SMEs, within the framework of the French Inter-ministerial Fund and Oséo (not including support for laboratories).

*Source*: BCG; CMInternational (2008), "Evaluation des poles de compétitivité, Synthèse du rapport d'évaluation", *http://competitivite.gouv.fr/documents/archivesAncienSite/pdf/synthese_BCG-CMI_evaluation_des_poles_de_competitivite.pdf.*

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## 6.3. Innovation support services for existing SMEs

### *Definition, rationale and objectives*

Small and medium-sized enterprises (SMEs) are a main source of employment and economic growth in OECD member countries. SMEs are the dominant form of business organisation, accounting, on average, for between 95% and 99% of all enterprises. They are responsible for between 60-70% of net job creation in OECD member countries and over two-thirds of EU GDP. SMEs innovate less compared to large firms and have on average only modest rates of turnover growth. Yet, even small improvements in SME productivity through innovation could provide a substantial contribution to aggregate growth when multiplied by the number of firms involved.

Within the SME universe, the two groups that have received considerable attention in recent years are high-growth and high-impact SMEs, including the so-called "gazelles". Traditionally, economic development funding had been focused on attracting outside firms or creating new firms. Evidence suggests the need for policies aimed at growing existing high-impact firms. Therefore such SMEs have received increasing recognition as contributors to wealth and regional development through the creation of new business and jobs (see Box 6.7).

#### Box 6.7. **High-growth, high-impact and gazelle SMEs**

Gazelle enterprises form a subset of the group of high-growth enterprises. According to one widely accepted definition, gazelles are high-growth enterprises born five years or less before the end of a three-year observation period. Most gazelles are not necessarily high-tech pioneers, but second-movers who copy and imitate existing technology or business models and exploit the right timing or business context to get the necessary volumes and profitability. One reason for their fast growth is the source of their differentiation, namely innovation. Innovation in this context need not necessarily be radical innovation, which accounts for less than 5% of all innovation. In SMEs (and large firms alike) innovation is usually incremental, involving all sorts of small changes to products, processes, organisational practices or marketing methods.

Empirical studies in the manufacturing sector in France, the Netherlands and Canada's province of Quebec have found a number of traits that are common to high-growth SMEs but make it difficult to define them as a homogeneous category (beyond their 20% annual growth rate):

- **Innovation:** growth is closely related to a company's ability to innovate. This involves continuous changes to products, processes and organisational and managerial practices.
- **Market/technology linkages:** high-growth firms are strongly market-oriented, forge links between their technology and markets and adapt their products to respond to consumer trends and client demands.
- **Organisation and management:** high-growth firms have a decentralised, participatory and readily adaptive organisation.

### Box 6.7. **High-growth, high-impact and gazelle SMEs** *(cont'd)*

- **Teamwork:** they encourage teamwork among all staff through regular communication, shared decision-making, skills training and profit-sharing mechanisms.
- **Networking:** they are well integrated into a network of alliances and partnerships with other firms, service providers and public and private institutions.
- **General distinctive features:** *i*) high-growth firms account for a great share of gross job gains; *ii*) can be found in all industries and in all regions; *iii*) tend to be start-ups; *iv*) not all high-growth firms operate in global markets.

Research suggests that high-growth SMEs are more often found in dynamic industries and regions. This can lead to a virtuous circle for some leading regions, while other less central or economically advanced regions may fall further behind. However, more recent research from the United States found that high-impact firms exist in all industries, not only in high-technology industries, albeit some industries have a higher percentage of these firms than others. Moreover, these high-impact firms exist in almost all states and counties.

*Source*: OECD (2002), "High-growth SMEs and Employment", OECD, Paris.; Government of Canada (2006), High-Growth SMEs: Financing Profiles, May; Niederbach, P., C. Alexander and A. Furlani (2007), "Exploratory Team Report on High-Growth Innovative SMEs", *PRO INNO Papers,* 3 May; PRO INNO Europe (2009), "Making Public Support for Innovation in the EU More Effective: Lessons Learned from a Public Consultation for Action at Community Level", Commission Staff Working Document SEC(2009)1197 of 9 September; Carroll, G.R. and M.T. Hannan (2000), *The Demography of Corporations and Industries*, Princeton University Press, Princeton; Davidsson, P. and F. Delmar (2001), "Les entreprises à forte croissance et leur contribution à l'emploi: le cas de la Suède 1987-1996"; *Revue Internationale PME*, 14(3-4):164-187; Acs Z.J., W. Parsons and S. Tracy (2008), *High-Impact Firms: Gazelles Revisited*, Corporate Research Board for the SBA, Washington, DC, available at *www.sba.gov/advo/research/rs328tot.pdf*.

However, smaller firms face greater barriers than larger firms for many aspects of innovation. Barriers include: access to finance, sourcing and absorbing technologies, and use of new management techniques due to limits in both internal capabilities (e.g. absence of specialised engineering personnel) and in linkages to external knowledge networks, disproportionate costs of regulatory compliance, etc. Many of the costs associated with regulatory compliance are fixed costs since a firm with five employees incurs roughly the same expense as a firm with 500 employees. To overcome such barriers, the US Small Business Administration (SBA) was created in 1953 as an independent agency of the federal government to aid, counsel, assist and protect the interests of small business concerns. Similarly, other countries have specific agencies and policies that target SMEs (OECD, 2010). National and regional policy makers are seeking to raise the number of high-growth enterprises in particular.

As the scope of innovation policy broadens, the range of innovation support instruments to SMEs is expanding. Innovation support services for SMEs can be defined as those forms of assistance not including direct financial support (grants, loans, equity). Some of these services (support to innovative start-ups, human capital mobility schemes, innovation vouchers, clusters and networks) are treated in more detail in other sections of this chapter. Innovation support services to SMEs can be grouped into two broad categories (see also Table 6.6):

- **technology transfer and diffusion:** support in the form of advice and counselling for technology transfer and uptake (absorption) by SMEs, including via sectoral or specialised technology centres; and
- **innovation management and non-technological innovation:** support includes innovation management advice, audits to identify needs, innovation coaching, as well as services such as design and support for marketing innovative products.

Table 6.6. **Categorisation of innovation support services**

| | |
|---|---|
| Collective actions | Awareness-raising activities for enterprises (e.g. study visits and conferences) |
| | Awareness-raising activities for the scientific community on research commercialisation and IPR |
| | Technology watch – analysis of evolving sectoral technological needs |
| | Collecting and disseminating information on relevant existing technologies |
| | Co-ordinating and disseminating information on available business services |
| Support to technological and scientific co-operation | Technological audit – analysis and identification of firm needs |
| | Search for regional and/or national (industrial or scientific) partners for R&D projects |
| | Search for international partners for R&D projects |
| | Technical and legal support for the preparation of project agreements |
| Support for new product and service development | Technical assistance towards preparing a feasibility study of a product/service |
| | Assistance to develop a business plan for a new product/service |
| | Assistance for prototype development (e.g. fast prototyping, etc.) |
| | Assistance for prototype testing |
| | Support in product launching or service implementation |
| Intellectual Property Rights (IPR) and commercialisation | Initial IPR check for products and services before their development |
| | Assistance in the commercialisation of industrial research projects, identification of IPR protection of results |
| | Assistance in patent filing and management of patent portfolios |
| Licensing | Industrial partner search for licensing |
| | Preparing and negotiating conventions (licence agreements) |
| Support to innovative start-ups and spin-offs | Legal support in creating a start-up |
| | Legal support in creating a spin-off |
| | Search for private financial partners for start-up/spin-off creation |
| | Preparing specifications and budget for spin-off creation |
| | Monitoring and promotion of start-ups/spin-offs |
| Human capital mobility | Placement schemes between academic/public research and industry |
| | Search for highly specialised R&D personnel |
| | Search for highly specialised management personnel (e.g. innovation and knowledge managers) |
| Networking and clustering | Supporting and creating business networks |
| | Supporting and creating SMEs and research base (university, research centres) networks |
| | Supporting and creating clusters and management of clusters |
| Assistance in accessing public funding for innovation activities | Search for public funding and monitoring of public tenders |
| | Assistance in submitting project proposals to regional, national or international programmes (e.g. EU FP). |

*Source: www.e-innovation.org/supersme.*

### *Technology transfer and diffusion*

Governments in many regions and countries have set up programmes to provide technological and/or manufacturing support services notably for SMEs. The support service may include targeted actions for intellectual property rights management, technology transfer and diffusion or technology watch. Special support may be offered through S&T parks, specialised regional or national technology transfer centres (e.g. innovation relay centres in all EU countries). External advisors can provide manufacturing and/or technological advice, sometimes in conjunction with funding for industrial R&D projects or investment support for new equipment and production technologies. Equally, innovation vouchers (see later section) often enable less innovative SMEs to take the first steps in collaboration for knowledge generation and transfer with specialised experts (contract research, licenses, research and IPR issues, etc).

In several OECD member countries, services are provided through regionally located offices of national agencies or networks. The development of specific regional level advisory services is often supported by national or supranational networks. This model enables local or regional administrations, in partnership with the business sector or higher education and research institutions, to develop tailored and targeted approaches to specific regional issues (e.g. depending on sectoral composition of the economy, export orientation, technology trends, etc.). In the Netherlands, for example, Syntens is a network of regional centres which aims to strengthen technological and non-technological innovation capacity of SMEs. Centres make relevant knowledge accessible and applicable for SMEs through customised advice and matchmaking. Syntens services are often the first step for bringing in (commercial) advisors or knowledge suppliers in innovation projects. Syntens is active in various networks with other Dutch national innovation system actors.

The United States and the United Kingdom have the most well-known programmes for manufacturing extension (and advisory) services. They include the Manufacturing Extension Partnerships (MEP) in the United States (see Box 6.8), and the UK Manufacturing Advisory Service (MAS). The premise behind these programmes is that smaller manufacturers are less likely to adopt modern production technologies and business practices. They lack the capacity and knowledge to move their activities beyond day-to-day survival. For instance, MAS is delivered through three main components: MAS Regional Centres, specialist support organisations and the MAS website.

In the United States and now Mexico, a network of small business development centres (SBDC) provides one-stop-shop management assistance to current and prospective small business owners. The programme is a co-operative effort of the private sector, the educational community and federal (US Small Business Administration), state and local governments. The MI-SBTDC in Michigan, for example, is headquartered at Grand Valley State University and supports 12 regional offices and over 30 satellite offices. Specialised teams have been created to assist SMEs: Small Business Team, Technology Team, Growth Group Team and the Manufacturing Assistance Team. The same model has been exported to Mexico, preserving ties with the US programme, and is now present in several Mexican states where universities manage the centres.

### Box 6.8. **US Manufacturing Extension Partnerships**

The US Manufacturing Extension Partnerships (MEP) is a network of 392 centres with 1 600 staff members spread across the country. The network aims to support the growth of SMEs with manufacturing activities. The centres provide direct assistance to companies in the form of advice for business development in view of process and product improvement. The centres also provide assistance for accessing training resources, or more specialised expert advice from other providers. Besides their own service delivery, the centres also help companies tap into existing resources, within their own area and beyond. They are actively promoting federal programmes offered by the Department of Defense, Department of Labor, the Environmental Protection Agency, and the Department of Commerce.

According to the MEP Network:

- for every USD 1 of federal investment, the MEP generates USD 32 of new sales growth for a total of USD 3.6 billion in new sales nationally.
- third-party client surveys indicate MEP creates and retains one job for every USD 2 000 invested, one of the best returns on federal funds.

*Source*: *www.nist.gov/mep.*

In addition, bottom-up regional initiatives use similar approaches to promote technology transfer. In the South East United Kingdom, the Innovation Advisory Service (IAS) offers several forms of business advisory. The IAS employs a team of innovation advisors that visit client businesses and work with them for between two hours and ten days, without charge. Advisors help firms to identify growth opportunities, access resources for innovation, and link into the regional and national knowledge base. Firms are identified by team of expert advisors. The programme was funded by the South East England Development Agency and delivered by a consortium led by Oxford Innovation and involving the National Physical Laboratory, the technology transfer company of the Rutherford Appleton Laboratory and Secro Science. In Flanders (Belgium), the Co-operative Innovation Networks (VIS) programme works through intermediary network organisations that actively support technological innovation in companies (see Box 6.9).

### Box 6.9. **Co-operative Innovation Networks (VIS): Flanders (Belgium)**

The objective of the Flemish VIS scheme (launched in 2002) is to stimulate technological innovation in Flemish enterprises, in particular SMEs. It does so by increasing awareness of and improving access to technological knowledge and supporting the implementation of knowledge in enterprises. The VIS programme is targeted to intermediary network organisations that actively support technological innovation in companies. It consists of six project types and one programme:

- collective research;
- thematic innovation stimulation;
- technological services;
- sub-regional innovation stimulation;

Box 6.9. **Flemish Co-operative Innovation Networks (VIS): Flanders** *(cont'd)*

- feasibility studies to prepare collective innovation initiatives; and
- co-operation projects to develop tools to increase the performance of the Flemish Innovation Network and the level of service quality.

The programme consists of competence poles, initiatives to substantially increase the knowledge for innovation for a specific sector (through collective research and knowledge dissemination). Projects are applied by a collective centre organised by VIS Decree, a consortium of mainly Flemish companies (a majority of SMEs) or an organisation that is representative of a group of companies. The grants will be max. 80% of total project/programme costs. The scheme is implemented and managed by the Institute for the Promotion of Innovation by Science and Technology in Flanders (IWT). Overall budget for 2000-2005 was EUR 140 million.

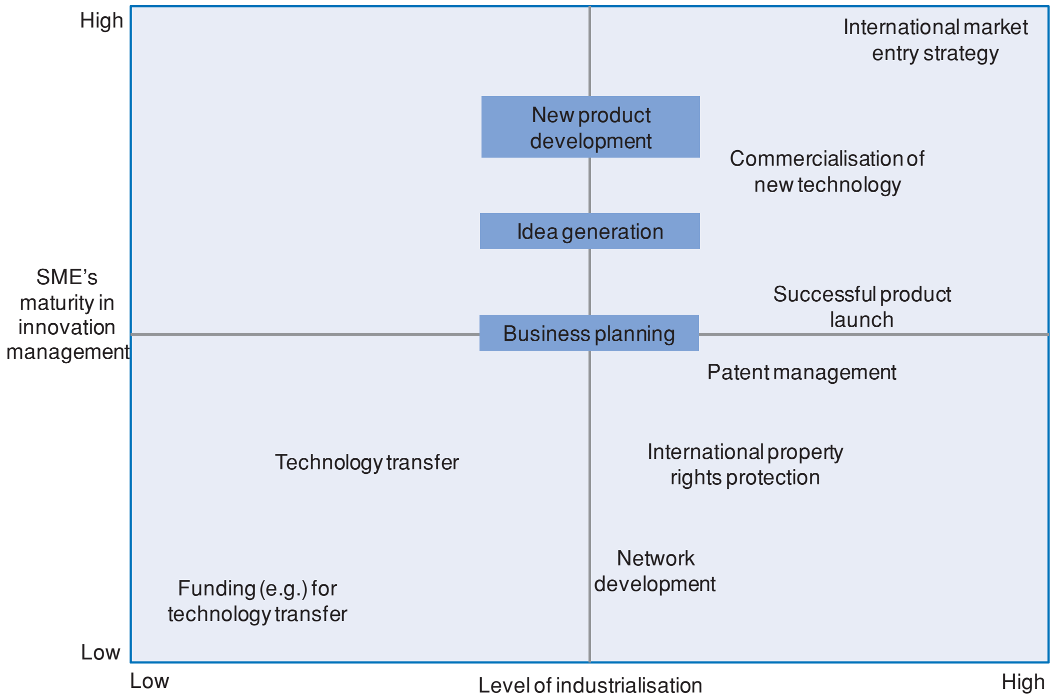
*Source: www.iwt.be.*

### *Innovation management and non-technological innovation*

Innovation Management (IM) has been defined as the capability of an enterprise to continuously manage inventions/ideas that could lead to an innovation. Such ideas, and their successful implementation, may concern new products or services, processes, production methods, organisational forms or elementary improvements of a business (model) system. In general, SMEs have a tendency to under-invest in novel and necessary competences related to IM. This may be explained by a number of obstacles, both on the demand side and the supply side. For example SMEs: lack funds for investments in IM; do not recognise IM as a competitive edge; lack information about the type and source of competence; etc. In addition, many suppliers in the IM market find larger enterprises and the public sector more attractive as clients. Those that do provide services to SMEs are often of poor quality. A 2006 review of the landscape of innovation management services in the EU argued that the sophistication of innovation management services varies according to both the individual SMEs but also the level of development (industrialisation) of a country (or region) (Figure 6.3). The types of non-technological support services typically offered to SMEs to improve innovation management include:

- **Innovation strategy:** SWOT (strengths, weaknesses, opportunity, threats) analysis, scenario building, trend extrapolation, technology scouting, economic/technological intelligence, competition analysis, customer needs assessments, road mapping, innovation audits, benchmarking, etc.
- **Innovation organisation and culture:** innovation awareness-raising (idea generation, creativity workshops, idea and concept screening, etc.), tools and methods for team building and improved social innovation.
- **Coaching** and mentoring to assist in managing the innovation process and projects (innovation life cycle methods, etc.).
- **Design and marketing** of innovative products/services, market research and analysis, participating in trade fairs, etc.

Figure 6.3. **Relative sophistication of innovation management techniques**




*Source:* European Commission (2006), "European Innovation Management Landscape. Assessment of Current Practices in Innovation Management Consulting Approaches and Self-Assessment Tools in Europe to Define the Requirements for Future 'Best Practices'", *Europe Innova Paper no 2*, published by DG Enterprise and Industry.

One specific example of a programme to support non-technological innovation is that of Aldatu in the Basque Country, Spain (see Box 6.10). It finances advisors to work with SMEs on developing an innovation agenda. The region also has long-standing public programmes to support excellence in management that are open to SMEs.

Design as a driver of innovation is being given increasing importance in many policy circles, both in terms of industrial design and on a wider scale in terms of creative industries or regions. A growing number of regions have developed specific regional design policies. For instance, the Flemish Ministry of Economy defines design as: "a holistic concept..., that besides the (re-)styling of products, extends to the application of innovative and alternative materials, ergonomics, engineering, ecology and ethics, psychology, culture and last but not least management". In addition to national design councils (Denmark, the United Kingdom, etc.) and programmes, design centres and design initiatives have multiplied in recent years at regional level, with notable initiatives in a number of European regions, not necessarily renowned for their design specialisation (such as Eindhoven, Netherlands or Essen, Germany and its "red dot" centre). In Italy, a country traditionally associated with design, regional centres aimed at promoting design skills in the business sector are also being developed, such as in Bologna (Box 6.11).

### Box 6.10. SME Innovation Support Programme Aldatu: Basque Country (Spain)

This scheme supports innovation projects within the scope of the 2010 STI strategy of the Basque Country. Support is granted for innovation advisory services to projects aiming to reframe the company strategy, to introduce organisation and market innovations and to develop innovation capabilities. Criteria for funding are:

- the projects selected for support will significantly change the SMEs' business strategy;
- the innovation projects will significantly affect the company's presence in one or more markets. Alternatively, the SMEs will seek to improve their services to the customers through the development of new and tailored product strategies. Or, they should aim to develop new, or substantially changed, communication and interaction channels with the customers; and
- the organisational innovation projects will facilitate the creation of new collaboration networks or new marketing networks. They may also support the set-up of new supply or purchase platforms.

Aid under this scheme can also be granted for the development of an integral innovation management system. Such an integral approach systematically considers activities for the development of ideas, the set-up of innovation projects and the measurement of innovative project results. Under the scheme, all activities can be undertaken in collaboration with two or more enterprises. Eligible costs are only the external consultancy costs. They are purchased at market price with public funding of up to EUR 90 000 per enterprise per year, not to exceed EUR 200 000 per enterprise within any three-year period. The maximum aid intensity is 50% of the eligible project costs. The current programme (2009-2013) has a total budget of EUR 30 million, approximately EUR 6 million annually

*Source: www.basques.euskadi.net.*

### Box 6.11. Design Centre Bologna (Emilia Romagna, Italy)

The Design Centre Bologna is a project of the Academy of Fine Arts in Bologna with funding provided by the Business Development Department of the Emilia Romagna Regional Authority and by contributions from the Foundation of Savings and Loans in Bologna. The centre is a design services provider, the first of its kind in Italy, with the primary objective of helping facilitate the economic implementation of entrepreneurial activities across the field of design, based on the extensive examples of similar models at an international level. The centre is overseen by a scientific committee composed of the leading figures in the world of design, and by a team of experts in the field, formed by representatives of the region, the academy, the foundation, and other design professionals.

The Design Centre is a research and development centre that: manages extensive databases; develops projects – not only at a local level, but also on a national and international scale; liaises among institutions and experts in the field of design; and provides a framework of global references as well as networks for the presentation of outstanding local services and products. The activities of the centre include workshops, conferences, consulting services, pilot projects, trend analysis, collaborative research, concept design and strategic design.

*Source: www.design-center.it.*

### *Regional dimension*

The relevance of the regional dimension for SME support is widely recognised given innovation dynamics, regional specificities and the increasing role of regions in innovation policy. Policies to support national systems of innovation focus on the central role that knowledge and innovation play in determining productivity and growth. However, regional factors help determine the extent of individual and organisational learning, technology transfer and innovation. Innovation support services for SMEs thus often require adaptation to regional environmental factors. And most SMEs are embedded in specific regional or local industrial clusters. From a conceptual perspective, spatial proximity often positively affects knowledge spillovers from firms and research organisations. Furthermore, there is evidence that learning and therefore innovation occurs through interactive, iterative and networked approaches. Studies of innovation survey data have found that the geographic scale of collaboration in many cases is greater for large firms than SMEs. There is also evidence, however, that such collaborations can often be non-local in nature. A recent study into the effects of social capital on SME performance, for example, found that both higher growing and more innovative firms tend to make greater use of non-local networks (Cooke *et al.*, 2005). This highlights a need to evaluate the importance of both local and non-local linkages in SME innovation and growth processes. Moreover, the multi-faceted nature of innovation processes suggests that linkages involve wide-ranging relationships (e.g. with other firms, government agencies, universities, etc.).

### *Evolution over time and variety*

Innovation today goes beyond the sole reliance on internal ideas from within a company, i.e. “closed innovation”. Innovation increasingly leverages internal and external sources of ideas and paths to market in more open approaches. This trend may help to break up the “knowledge monopolies” of large firm R&D laboratories and open up innovation to smaller enterprises that participate in knowledge transfer networks with universities, large firms and other players. Not all firms and sectors are heavily involved in collaborative or open innovation and some activities remain in-house, but as a general trend there is increasing collaboration among external actors in the innovation process. This is observed in patent data and other sources. The collaborations involved range from joint ventures and joint development contracts to contract R&D, licensing and venturing, including small firms as well as large ones. External ideas for innovation in SMEs can come from many places – from collaborations with universities, other firms or business angels, from labour mobility among firms and organisations and from informal social capital contacts. Another increasingly important source is the consumer, for example in helping to test new products, often aided by ICTs.

To better seize the opportunities associated with more interactive and open innovation process, SMEs require new forms of support. SMEs will need to be embedded in knowledge networks, in turn requiring both connections with other players and capabilities to exploit these connections and absorb knowledge from elsewhere. It also implies the need for support to evolve from single-firm and financial approaches to include systemic and soft support. The adoption of a broad concept of innovation expands the scope of innovation support services. Over time, there has been a tendency to deliver a larger set of services to SMEs. Another implication of these trends is that innovation support to SMEs should not be constrained by administrative borders, so as to facilitate knowledge spillovers and exchanges across functional regions (see Box 6.12).

### Box 6.12. **Supporting SME innovation in Lower Austria: a cross-regional and multi-facetted approach**

Lower Austria is located in the north-east of the country, surrounding the Austrian capital city and province of Vienna. The region benefits from a well-developed infrastructure and has traditionally had a high level of influence on the political and economic development of Austria as a whole. Structural problems remain, however, in the old industries and in the large rural area. The region is deficient in the field of technology mainly due to the under-representation of future technology sectors and corresponding SMEs. The region is seeking to upgrade its SME base through increased collaboration with Vienna in terms of facilitating firm access to educational institutions and technology providers, as well as to services. Lower Austria and Vienna have joined their innovation forces and markets under the common label "Vienna region".

The regional development strategy with special focus on the regional innovation support structure is documented in the "Regional Innovation System of Lower Austria". ECO Plus, the *Länd*'s regional development agency, promotes business creation and cluster management, co-ordinates the management of industrial and business parks, and is responsible for cross-border projects and EU enlargement. Together with the *Länd*, it holds shares in various regional development entities, such as the regional innovation centres. The Technology and Innovation Partners, which are a common initiative of the *Länd* and the Chamber of Commerce, are local contact points for innovation and R&D in enterprises. Other regional or local contacts include the regional management units and NÖBEG providing start-up capital for innovative businesses. The region is also seeking to increase the number of innovative, technology-oriented SMEs. To mobilise this potential is the aim of GENIUS, the new SME initiative, which aims to identify technologies in their environment that present a suitable basis for a start-up.

*Source: www.ris-noe.at.*

### *Success conditions and impact*

As with innovation policy generally, policies for innovation support services to SMEs need to address particular market or system failures that warrant public intervention. One very important success condition for innovation support to SMEs is that public action does not crowd out private initiative. This is a major concern for many kinds of services provided to SMEs by public actors. Another key issue relates to the type of diagnostic or advisory services that enterprises must undergo to access funding. Policy makers need to ensure that public funding has the highest impact on productivity and expansion of international potential (moving firms up the value chain). Furthermore, there have been problems with regional SME innovation support programmes when the advisors reviewing SME needs were also selling services. In those cases, the conflict of interest in the simultaneous roles of advisor and service provider can result in ineffective spending.

According to the results of a public consultation in the EU, the four most frequently provided forms of innovation support to enterprises over 2006-2008 were: financing for innovation projects; support to networking and co-operation; awareness raising; and technology transfer. More than two-thirds of the enterprises surveyed reported having received some form of support. For most reporting firms, that support accounted for less than 10% of their overall spending on innovation.

The direct impact of innovation support services for SMEs is a higher level of innovation activity than would have occurred without support. This innovative activity should subsequently lead to measurable firm outputs. However, because of the attribution problem (the difficulty to link innovative outputs to occurrence and intensity of public intervention) it is not realistic to measure impacts of soft support services in terms of firm performance. Measuring behavioural additionality is needed but is difficult and costly to do. Satisfaction surveys and SME innovation surveys can help shed light on the relevance and effectiveness of regional innovation support services. Results from these exercises should be integrated in the design of the services in order to improve their outputs.

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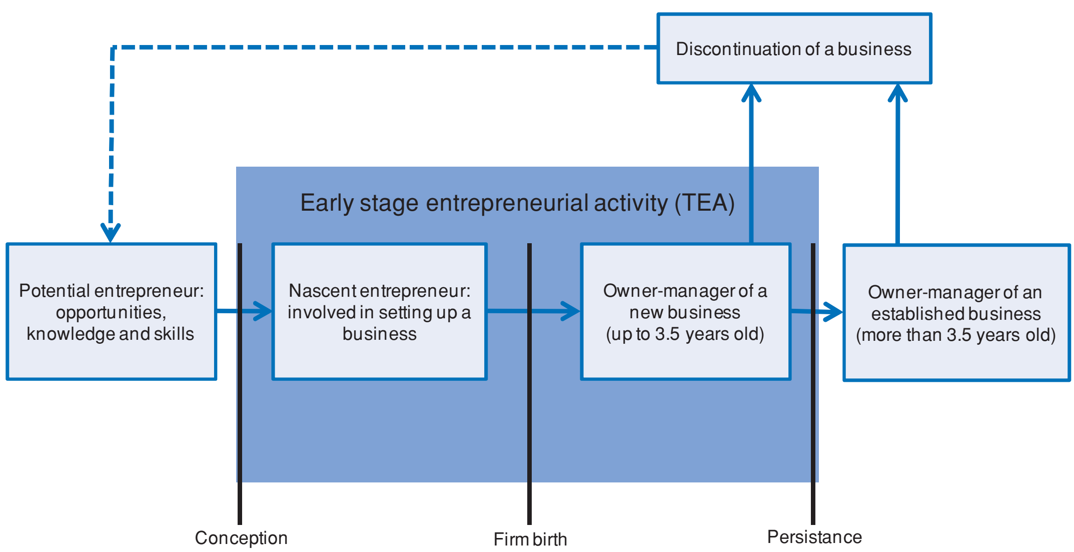
## 6.4. Support for innovative start-ups

### *Definition, rationale and objectives*

Innovative new firms and new technology-based firms (NTBFs) are seen as agents of change in the economy. They introduce new products, services and more efficient ways of working. Entrepreneurs and their willingness to take risks are fundamental aspects of economic cycles, as they bring about innovation, create new companies and drive out non-competitive firms in a process of "creative destruction". Because of market and system failures, investments in innovation may fall short of the socially optimal level. The aim of public support for start-ups and NTBFs is to address those failures by providing support at various stages of the entrepreneurial process (Figure 6.4).

Figure 6.4. **The entrepreneurial process and GEM operational definitions**




*Source:* Bosma, N. and J. Levie (2009); *Global Entrepreneurship Monitor (GEM) 2009 Executive Report*.

It is generally agreed in policy circles that there is a need to subsidise early-stage entrepreneurship. The financial system is often unwilling to finance high-tech and innovative start-ups. Among the main factors hampering innovation activities, the most relevant barriers identified by enterprises are: lack of access to finance; high costs of innovation; and lack of incentives facilitating cooperation among actors. To a lesser extent, difficulties in finding partners for innovation and lack of knowledge about support instruments also negatively influence innovation efforts by firms.

Support to start-ups, spin-offs and high-tech/high-growth SMEs in general is a policy focus of supranational, national and regional governments (see section on "Innovation Support Services for SMEs"). The majority of policies that are applicable to such companies tend to be generic SME support policies. They foster the development and growth of existing SMEs through the provision of various forms of direct and indirect support or via the adjustment of framework conditions such as barriers to company formation, etc. Nevertheless, there are also policies or initiatives that explicitly target support for innovative start-ups and innovative NTBFs. These support instruments stimulate the creation of new companies, but also stimulate entrepreneurship as a pre-condition for the emergence of these companies.

There is often an implicit assumption that many of these policy initiatives will benefit newly created companies that are innovative, and therefore have a high growth potential. High-tech or knowledge-intensive companies are often targeted with the expectation that they will be more innovation-oriented than "traditional" companies. Typical forms of support aim to: promote entrepreneurship; reduce barriers to company formation; promote capital markets and increase the availability of seed capital, venture capital and later growth capital; improve access to business angels; provide more general forms of managerial and advisory support; and offer targeted support such as grants for research, infrastructure and capital equipment.

Spin-offs represent an important mechanism for technology transfer. A spin-off is a new company typically founded around a core technological innovation that arises from a parent organisation. Often an employee (or employees) leaves the parent organisation, taking along a technology that is the basis for the company creation in a high-technology industry. Spin-offs may also be created to exploit intellectual property developed in a university or public research centre as well.

Support instruments for innovative start-ups and NTBFs can be classified into three broad sub-categories based on each instrument's main support target:

- development of innovative products – **proof of concept** (from R&D to market services);
- creation of innovative companies – **incubators** and related advisory services; or
- improvement of early-stage innovative firm capitalisation – **business angels**, seed and early stage **venture capital** schemes.

### *Proof of concept*

Proof of concept or "from R&D to market" services include advisory services and grants for product development and commercialisation by start-up companies and NTBFs. These support instruments may be targeted to firms (see Box 6.13), but are often linked to university spin-off services (see Boxes 6.14 and 6.15).

#### Box 6.13. **Innotek: creating high-tech spin-offs in Flanders (Belgium)**

Innotek was launched in 1987, when the Regional Development Authority for the Kempen/Antwerp region of Flanders and the local Chamber of Commerce added an extra pillar of local knowledge and entrepreneurship to their regional development policy. Initially, Innotek's main objectives were to stimulate innovation in start-up companies and existing SMEs through information sharing and individual coaching. Gradually, its activities grew and became more diverse: an incubation building (Technology House); specialised ICT-advice; a network of tele-offices; teleworking consultancy and a call centre (Innocall).

### Box 6.13. **Innotek: creating high-tech spin-offs in Flanders (Belgium)** *(cont'd)*

Today, Innotek activities focus on new business development (stimulating entrepreneurship), internationalisation and spin-off creation from both industrial or services companies and research centres. Innotek has been working with different organisations in the region to foster the creation of new spin-offs: VITO (Flemish Institute for Technological Research), the SCK (Nuclear Energy Research Center), the KHK (Kempen Higher Educational Institute), Belgoprocess and the University of Antwerp. Innotek also has broad experience in industrial spin-off creation. In the past years a new methodology has been developed encompassing three steps, all under the supervision of spin-off experts:

1. investigating the real potential of companies to produce a spin-off company ("scouting");
2. executing spin-off scans: relevant features of the parent company, the spin-off team and the spin-off activity are highlighted ("scanning"); and
3. guidance for spin-off projects ("coaching").

Applying this methodology, Innotek and the BOM (*Brabantse Ontwikkelings Maatschappij*) of the Netherlands in the framework of Interreg IIIA "Spin-offs Pilot Project" were able to create 16 external and 36 internal spin-offs. Following this success, Innotek is now running an industrial spin-off project for the whole region of Flanders.

*Source:* EC Directorate General Regional Policy, Inforegio (2007), *http://ec.europa.eu/regional_policy*.

### Box 6.14. **Advantage Proof-of-Concept Grant Fund: West Midlands (United Kingdom)**

The Advantage Proof-of-Concept Grant Fund was backed by the Advantage West Midlands Regional Development Agency and the European Regional Development Fund. The Grant Fund was designed to support established and start-up businesses developing innovative new products and processes and to assist in the spin-out of new enterprises from universities in the West Midlands. It supported applicants to investigate, advance and protect early stage innovative business ideas and to commercialise new innovations.

All high-quality applications were considered regardless of sector; however, priority was given to five key technology areas: advanced materials, healthcare technology, energy technology, transportation technology, and digital media. Projects that can be supported by the fund must fall into one of the five categories: market assessment, IPR protection of innovative ideas, basic prototyping, outline business planning, and limited management support to establish the commercial viability of business concepts.

The fund totalled approximately GBP 5.8 million (EUR 6.8 million). Applicants applied for grants of between GBP 5 000 and GBP 30 000, representing up to 75% of total project costs (generally above 15 000). The fund awarded grants on a rolling basis at the rate of 10 to 20 per month until 3 March 2010.

*Source:* Advantage Proof of Concept Fund (2010), *www.advantageproofofconcept.co.uk*.

### Box 6.15. **Financial support for new innovative companies: Emilia-Romagna (Italy)**

The measure (2010-2011) supports the start-up of knowledge-intensive firms through economic valorisation of research and the development of products and services based on new technologies. It funds investments in tangible and intangible assets that are necessary for firm growth.

The measure is aimed at firms that fit at least one of the following criteria:

- established with the support of the Emilia-Romagna High-Tech Network;
- university and public research institute spin-offs;
- one of the associates in the company holds a research scholarship from a regional research institution; and
- firms in high-tech industries (biotech, nanotech, advanced mechanics, ICT, renewable energy).

The initiative contributes to business start-ups covering up to 70% of capital investment costs and up to EUR 100 000. Funding sources include national and regional sources as well as the EU Structural Funds. For 2010 and 2011 EUR 745 000 has been allocated annually from all three sources.

*Source:* European Commission (2010), CORDIS website, *http://cordis.europa.eu*.

## *Incubators*

Incubators are infrastructures designed to accelerate the successful development of innovative companies through an array of business support resources and services. Services are provided by incubator management and offered both in the incubator and through its network of contacts. Incubators vary in the way they deliver their services, in their organisational structure, and in the types of clients they serve. Successful completion of a business incubation programme increases the likelihood that a start-up company will stay in business for the long term. Historically, in the United States 80-90% of incubator graduates have stayed in business (NBIA, 2007).

Incubators differ from S&T parks in their dedication to start-up and early-stage companies. S&T parks, on the other hand, tend to be large-scale projects that house everything from corporate, government or university labs to very small companies. Most S&T parks do not offer business assistance services, which are the hallmark of a business incubation programme. However, many S&T parks house incubation programmes.

The amount of time a start-up or NTBF spends in an incubation programme varies, with an average of 33 months (Knopp, 2007). The duration depends on a number of factors, including the type of business and the entrepreneur's level of business expertise. Life science and other firms with long research and development cycles require more time in an incubation programme than manufacturing or service companies that can immediately produce and bring a product or service to market. Many incubation programmes set graduation requirements by development benchmarks, such as company revenues or staffing levels, rather than time in the programme.

Although most incubators offer their clients office space and shared administrative services, the core of a true business incubation programme is the services it provides to start-up companies. More than half of incubation programmes surveyed by the US National Business Incubation Association (NBIA) in 2006 reported that they also served affiliate or virtual clients. These companies do not reside in the incubator facility. Virtual clients may be too remote from an incubation facility to participate on site, and so receive counselling and other assistance electronically. As of October 2006, there were over 1 400 incubators in North America, up from only 12 in 1980. Of those, 1 115 were in the United States, 191 were in Mexico and 120 were in Canada. US NBIA estimates that there are about 7 000 business incubators worldwide (NBIA, 2010).

Acceptance criteria vary by programme, but in general only those starting enterprises with feasible business ideas and a workable business plan are admitted. It is this factor that makes it difficult to compare the success rates of incubated companies against general business survival statistics. Incubation programmes can be generic and accept companies in any sector, or specifically dedicated to some sectors, such as ICT or Biotechnology (see Box 6.16).

### Box 6.16. **Bioincubator in the Canavese Bioindustry Park SpA: Piedmont (Italy)**

The self-declared objective of the bioindustry Park is to develop in the region of Canavese a network of life-science industries (biochemistry, pharmacology, medical diagnostics, veterinary medicine, food, cosmetics, bio-engineering, bioinformatics, etc.). For that end a “cluster” or a regional system has been set up which integrates, temporally and spatially, all the key success factors: the capacity for R&D, training and transfer of technology, and the necessary conditions for business activity and financing. The bioindustry park forged, from the outset, close links with the University of Turin – two departments of which are housed in the park.

Construction began in 1995 and the park became operational in 1998. It gives priority to small and medium-sized biotech businesses wishing to develop innovative projects. To assist their installation, particularly for those not already present in the region, three mechanisms are in place: necessary space and utilities (16 000 $m^2$ of laboratories and pilot production installations) are made available, a complete range of common but individualised services is provided, and access is given to the R&D activities and technology transfer carried out by the Integrated Laboratory for Advanced Methodologies (LIMA), co-managed by Turin University and the National Research Council. LIMA is also a training centre for biotechnology and applied research methodology. The project has been orientated since its inception towards creating start-ups and spin-offs. With the support of EU Structural Funds, a bio-incubator was constructed on-site, and 2004 saw the launch of the “Discovery” initiative, aimed at identifying innovative projects and supporting business creators. A company providing seed capital made up of non-institutional investors was formed for this purpose.

Since 1999, the park has seen over 20 start-ups established. R&D activities have resulted in over 25 patent applications and the publication of over 100 scientific articles. Moreover, the park has worked in partnership with institutions such as the Università Uninsubria, Turin Polytechnic, the University of West Piedmont, and the Piedmont “Tecnorete” (a grouping of six scientific parks in the region). In 2006, an agreement was made with the Association for Biotechnology Development in the area of Grenoble (ADEBAG, France) and with BioAlps (Switzerland) with a view towards creating a trans-Alpine biocluster.

*Source:* Inforegio (2010), “EC Directorate General Regional Policy”, *http://ec.europa.eu/regional_policy.*

### *Business angels and venture capital (VC)*

Business angels and venture capitalists typically play a much more active role in the firms they invest in relative to lenders, since they own an equity stake in the firm. A considerable amount of risk is transferred from the entrepreneur to the investor. As a consequence, these investors provide managerial support to the founding team as well as links to customers, other investors and suppliers, and helping build the firm to the point it can be sold. VC is specialised: most investments take place in a very few sectors that generate extremely high rates of return that VC investors need to cover their high fixed costs. These sectors are mainly biotechnology and healthcare, information and communications technology, and increasingly green-tech. VC is a very specific form of investment that is only suitable for a tiny minority of firms in any economy.

While all start-ups get initial financing from the founders themselves and informal investors, very few raise funds from VC firms. For example, in the United States there are nearly 30 million businesses, but in the last 40 years no more than about 30 000, or about one in a thousand, have ever received venture capital. Only 1 179 US companies received their first round of VC in 2008, and of those only 330 were seed or start-up stage companies. In the whole of Europe, only 594 seed stage companies received venture capital in 2008 (Mason, 2009).

Although the number of VC-backed companies is minute, their combined contribution to the economies of their regions, countries – and often, the world – is large. From 1997 through 2004 the employment growth in European VC-backed companies was 30.5% (Philippon and Véron, 2008). In the United States, since the early 1970s, approximately USD 456 billion of venture capital has backed 27 000 companies. In 2008, those VC-backed companies employed more than 12 million people, or 11% of private sector employment, and generated revenues of USD 2.9 trillion, or 21% of US GDP.

Since VC funds in the United States have substantial documented economic impacts, other national and regional governments have sought to replicate that success. In the United States there is substantial government support for early stage development of NTBFs through subsidies to R&D (including over USD 32 billion a year for the National Institutes of Health) as well as direct financial support for investors through private VC. The United States government provides support for some 20-25% of all the funds invested in start-up firms which is about two to eight times what is invested by purely private VC. Similarly, in the United Kingdom, about half of all early stage VC investment is done through hybrid funds. In Spain, VC actually began as a public sector tool for supporting lesser-developed regions. There exist numerous regional examples of fully public and hybrid support to VC and business angels (see Boxes 6.17 and 6.18).

### *Regional dimension*

Regional governments are active in several non-financial and financial initiatives for start-ups and NTBFs, covering the three forms of support: proof of concept; incubators and finance. Among the three sources of financial support to address capital constraints of such firms are: government-backed venture capital funding, the provision of loan guarantees, and government grants for R&D and innovation.

### Box 6.17. **Inventure Fund Ky in Southern Finland: building a portfolio of high-tech start-ups**

In May 2008, the European Investment Fund announced an investment in Inventure Fund Ky, a Southern Finland (*Etelä-Suomi*)-based fund focussing on innovative technology companies. The first closing was completed at EUR 35.4 million with a final target of EUR 50 million. The fund targets technology-based companies with global market potential and attractive business model which are active in the software, electronics, semiconductors, industrial production and material technologies sectors. The aim is to build a portfolio of 15-20 start-up companies, with an average investment of EUR 1-3 million per company. This investment was made under the European Commission Competitiveness and Innovation Framework Programme.

*Source:* Inventure Fund Ky (2010), *www.inventure.fi.*

### Box 6.18. **LINC Scotland: Investment Facilitation Grant stimulating business angel potential**

LINC Scotland is the Scottish association for business angels, with a membership network of hundreds of investors including those operating individually as well as syndicates and investor groups. LINC was launched to facilitate private or hybrid investment in firms initially rejected by venture capital investors. This government-run grant scheme enables investors to cost-effectively pursue opportunities that they might otherwise have rejected in a traditional venture capital scheme. Potential investee companies apply in response to the feedback they received from potential investors on what issues need to be resolved to make them investable (e.g. costs relating to market analysis and access, technology validation, legal due diligence). The grant, which is limited to a maximum of GBP 15 000 of eligible costs, becomes convertible into LINC Scotland equity if the investment goes forward.

*Source*: Mason, C. M. (2009), "Public Policy Support for the Informal Venture Capital Market in Europe: A Critical Review", *International Small Business Journal*, 27.

The main rationale for a regional dimension is the possibility to capitalise on proximity relationships. Such proximity facilitates access to resources and tacit knowledge, networking with partners, and the development of trust relationships. Trust is particularly important for venture capitalists and business angels. A recent study of the effects of social capital on the performance of SMEs in 12 regions in the United Kingdom found that innovative firms tend to make greater use of collaboration and information exchange, are involved in higher trust relationships and make greater use of cross-locality networks (Cooke *et al*., 2005).

Private venture capital funds are likely to cluster in particular regions. They require a critical mass of perspective deal flow. Therefore, another practice by regional governments where there are no local venture capital firms, is to organise events where venture capitalists come to the region to meet prospective firms.

There is a risk of overlap between the support mechanisms for start-ups and NTBFs provided at regional, national and supranational levels. However, potential synergy effects may also exist that need to be fully exploited. Regional support for start-ups and NTBFs should be combined with other support coming from national (or local) sources. Even in federal countries, this multiplicity of support sources is visible, and the search for synergies not always a priority (see Box 6.19).

### Box 6.19. **Federal and regional support for innovative high-growth SMEs: (Belgium)**

Both federal and regional governments in Belgium are active in supporting innovative start-ups and NTBFs. Thus, in Wallonia, while there is no specific programme directed towards high-growth SMEs, since 2002, the region has provided support to the Academy for Growth of Companies in Wallonia, which brings together the managers of the region's high-growth SMEs. Based on the model of a similar initiative developed in Flanders (iGMO, 1993), it aims to be a place for contact, exchange of experience, coaching and thinking on issues linked specifically to the strategy and growth of these companies.

Schemes exist both at the federal level and in Wallonia (since June 2008) for young innovative companies. At the federal level, companies qualifying for support are small businesses that dedicate at least 15% of their expenses to R&D, are less than 10 years old, have fewer than 50 employees and EUR 6.25 million turnover excluding VAT. Only truly new companies qualify, excluding those generated from mergers, restructuring, re-start or extension of activity. The support takes the form of a partial exemption of advanced tax payment for wages of personnel involved in R&D. In Wallonia, these companies will be eligible for several types of grants. Young innovative companies are classified as firms less than 6 years old and either developing innovative products but with a high risk of failure, or dedicating 15% of their expenditures to R&D.

Although Flanders had a policy to double the percentage of gazelles by 2010, there are no specific instruments for these firms. Gazelles can still profit from the financial arrangements of the start-up policy (e.g. ARKimedes, although the investment maximum is EUR 1 million) and can participate in the generic (horizontal) policy instruments of the Flemish innovation policy. However, the procedures in these programmes may be too lengthy to play a major role in the expansion of these fast expanding, dynamic companies. Participation in government investment funds (PMV (all Flanders) and LRM (Limburg region)) may be more suitable.

*Source:* INNO-Policy TrendChart (2008).

### *Evolution over time and variety*

Research results indicate that the vast majority of new firms will neither innovate nor grow, and hence have a very limited economic impact. The majority of new firms will never actually employ staff beyond the founder. For example, in Finland, the median size of new firms three years after creation was still one (MTI, 2007). Hence, there is an evolution of policy approaches from helping creation of new firms towards ensuring their sustainability and growth.

Innovation policies need to adapt to the diverse needs of different types of entrepreneurs seeking to start NTBFs. The development of the firm may require different support to the founders. On form of support is to optimise innovation management – whether in more open or proprietary (intellectual-property based) innovation processes. Another is to seize selectively new opportunities in a global market, where speed of action and reliable partnerships are crucial. Regional system-oriented mechanisms serve to accelerate knowledge transfer, including towards those to start-ups and NTBFs. Equally, support for the development of regional innovative clusters can be rationalised both in terms of joint development of innovative products and supporting rapid internationalisation of start-ups and NTBFs.

### *Success conditions and impact*

Public financing schemes (grants, seed capital, venture capital, loan guarantees) to NTBFs and other start-ups is fragmented and fails to mobilise private sector investment efficiently or consistently (Innovation Unlimited, 2009). National and regional funds often lack size and expertise, while companies continue to lack growth financing. Intellectual property and know-how developed by start-ups, NTBFs and universities typically remain undervalued and underutilised. Hence, there is a need for a radically new approach to financing innovation, which transforms the fragmented short-term approach of governments, private finance and long-established companies. This means new partnerships to share risk, better harnessing of the knowledge and skills of entrepreneurs and companies, and more intelligent ways to combine funding between instruments (e.g. grants, equity, loans, fiscal incentives) and across countries.

The Small Business Act for Europe (2008) promotes harmonisation and good practices in policy support to start-ups and NTBFs. Unfortunately, the prior European Charter for Small Enterprises launched at the Lisbon Summit in March 2000 did not offer strong mechanisms to measuring policy results. One of the areas where more results were expected is the establishment of a one-stop-shop with reduced time and cost for registering companies: so far only Belgium, Denmark, Estonia, France, Hungary, Portugal, Romania, Slovenia and the United Kingdom fully comply with the EU objectives. This is likely to the slow down creation of new innovative firms in Europe.

Not only is venture capital a very expensive form of capital, the high fixed operating costs call for minimum fund sizes and diversification of deal flow. In the United Kingdom, recent research suggests that the minimum size of a 10-year fund seeking to make a commercial return should be approximately EUR 40-60 million (Nightingale *et al*., 2009). Regional venture capital funds that are much smaller than this would have difficulties financing the required investment team and meeting private sector investor return targets. While the benefits of a working venture capital industry are very significant, the ability to build a successful venture capital industry is often lacking. While Israel has managed a successful VC industry, as well as the United Kingdom, most international attempts to develop a venture capital industry have been unsuccessful. Even in the case of the United States it is not clear that the venture capital industry could survive outside of major centres such as Silicon Valley and Boston without government support.

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## 6.5. Innovation vouchers

### *Definition, rationale and objective*

Innovation vouchers entitle the owner to approach a knowledge institution to obtain services for innovative projects. They differ from traditional policy instruments since they are allocated directly to users (companies) rather than service providers. Voucher schemes are introduced by policy makers to allow knowledge, held by (usually public or semi-public) research and technology organisations (RTOs) to play a role in developing new products, processes and/or services. In general, they seek to increase the number of innovating SMEs and encourage regional innovation system linkages through their collaboration with RTOs.

Reducing barriers that hinder SME capacity to invent and successfully commercialise new products, services or processes is the main rationale for these regional innovation instruments. SMEs often lack in-house technical expertise and infrastructure for R&D, as well as innovation management skills. The capacity of many SMEs to hire skilled people for innovative projects and activities is also limited. Innovation vouchers are also used to overcome a co-operation barrier, by making them more aware of the opportunities which external know-how, available at RTOs, offers them. This instrument serves to change the behaviour of SMEs so as to integrate new knowledge and/or hire innovation specialists.

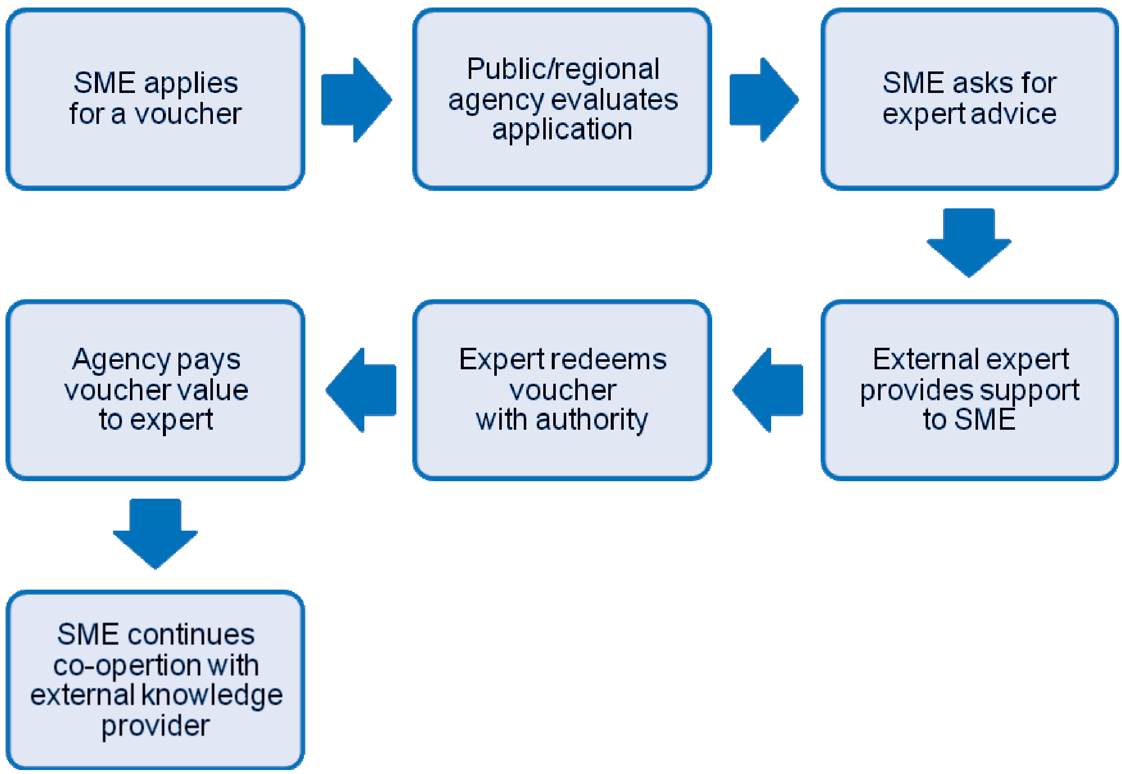
Only a small number of SMEs use funding schemes. Innovation funding schemes often involve high administrative costs, complicated administrative requirements and long delays (between the proposal submission, start of the activity or service and the first payment). Innovation vouchers, as a versatile instrument, respond to the above-mentioned barriers through simple and fast procedures, generally a matter of days rather than weeks or months. An SME with a voucher can seek academic expertise, usually from pre-approved universities and research institutes, to solve a specific problem or develop a new business idea. The company pays the researchers or consultants with the voucher, which in turn is reimbursed by the issuer, such as a national or regional authority (see Figure 6.5). The SME decides for which concrete purpose it will be applying for the voucher.

### *Regional dimension*

National and regional governments have both developed such programmes. Implementation at either level presents advantages and disadvantages. For example, regional programmes may be more tailored to conditions of particular firms; however, the spatial area to use the voucher may need to be wider than the region to enable the SME to find the right innovation support.

- **national schemes** are present in several countries, including Austria, Denmark, France, Greece, Ireland, Netherlands, Poland, Portugal, Slovenia, and Switzerland.
- **regional schemes** exist in many OECD regions, such as Bavaria, Baden-Württemberg, North Rhine-Westphalia (Germany), Flanders and Wallonia (Belgium), or North-East England, Scotland, Yorkshire and Humber and West Midlands (United Kingdom).

Figure 6.5. **Typical innovation voucher workflow**




*Source:* Technopolis (2010), based on Krell, Katherina, "Innovation Vouchers: Versatile and SME Friendly Innovation Support Instruments", *www.greenovate.eu*, presentation at the ERRIN workshop, 25 June 2010, *http://errin.eu/en/upload/Events/june09/Innovation_vouchers_commercialisation_Krell.pdf*.

## *Evolution over time and variety*

Vouchers schemes have recently become an increasingly popular way for countries and regional bodies to support business innovation activities. The number of innovation vouchers schemes has dramatically increased in Europe. Prior to 2006, only a handful of innovation voucher schemes existed; by 2010 there are approximately 25 schemes in operation. Limburg (Netherlands) with the so-called "research vouchers" was one of the first initiatives, dating back to 1997 (Box 6.20).

Innovation vouchers are also starting to be used outside the EU. In Switzerland, April 2009 was marked by the launch of the pilot project "SME Innovation Voucher" as part of the second phase of stabilisation measures. The first analyses have revealed that the number of requests for these vouchers has greatly exceeded expectations of the 133 initially granted. In March 2009, a similar scheme was set up in Singapore to encourage SMEs to adopt technology and innovation to create new growth opportunities. This pilot Innovation Voucher Scheme endeavours to support SMEs to tap the extensive engineering and resource base of the centres of innovation for assistance with their technology innovation projects. The Alberta Government Ministry of Advanced Education and Technology in Canada has been running the Alberta Innovation Voucher Pilot Programme since 2008. Vouchers are provided to technology-based SMEs and knowledge-driven businesses and help to structure development projects and assist Alberta technology companies to apply for a voucher.

### Box 6.20. **Innovation vouchers for SMEs in Limburg (Netherlands)**

The region of Limburg (Netherlands) began using the innovation voucher concept in 1997. This first pilot was an innovative approach and was explicitly aimed at encouraging the transfer of knowledge and collaboration between SMEs and research institutions. The general aim was to encourage, advise and support SMEs in Limburg as they undertook measures to maintain or improve their competitiveness in the domestic and international markets.

The project's target group was SMEs located in Limburg with 15-250 employees and DSM research, a private research and development campus where vouchers could be utilised. The responsible authorities were the regional development agency NV industriebank LIOF and the Province of Limburg. There was no maximum monetary amount linked to the voucher. Instead, the voucher entitled the SME to a maximum of three years research consulting at DSM research.

During the three years that the project lasted (until 1999), two interim evaluations were carried out. The evaluation results showed that the project had been generally successful. Although interest in the vouchers was initially low, the participating SMEs were satisfied when the implementation process started. The way in which DSM approached the companies was also very much appreciated. The greatest progress was therefore made in this particular area, offering a high level of know-how with a customer-friendly, attentive attitude.

Nevertheless, the results were disappointing in terms of making companies aware of the range of different fields in which DSM can provide expertise. However, the companies quickly benefited from redeeming the voucher. In most instances, the benefits were incremental improvements rather than radical innovations. Nevertheless, it confirmed that the voucher was a good way of awakening the enthusiasm of SMEs for innovation and for using external sources of know-how.

*Source:* European Policy Trendchart, *http://proinno.intrasoft.be/index.cfm?fuseaction=wiw.measures&page=detail&id=-1659&CO=2*, *www.ct.innovons.be.*

Despite the novelty of innovation vouchers, two generations of innovation vouchers can be observed. The first generation vouchers, which have been taken up by many national and regional innovation agencies in the EU, refer to those vouchers supporting co-operation between SMEs and RTOs. Recently, second generation vouchers have been started with a number of variations and with a wider innovation focus. These support schemes allow SMEs to get advice on their innovation and expansion plans, business strategies, or any other innovation initiative (See Boxes 6.21 and 6.22)

### Box 6.21. **Technology vouchers: Wallonia (Belgium)**

Launched in January 2009, the Technology Vouchers aim to be a flexible and simple measure to support SME innovation efforts. The Walloon government entrusted the management of this scheme to the recently created Agency for Technology Promotion. The support measure takes the form of an electronic voucher with a face value of EUR 500. The supported SME only pays 25% of the value compared to 75% by Wallonia and the European Regional Development Fund (ERDF). The overall budget for the period 2009-2013 is EUR 16 million out of which EUR 12 million are provided by the Walloon Region and the remainder by ERDF. This amount represents 32 000 vouchers by end 2013.

Technology vouchers seek to improve the technological capacity of Walloon businesses, regardless of the industry. During the exploratory stage, the process of technical feasibility or the development stage, a wide range of technological services can be paid for by the voucher: tests and preliminary analysis; life-cycle assessment of new products and analysis of impacts in the long term; prototype and testing with clients; and preparation for industrialisation. The company interested in the scheme has to contact one of the 22 research centres accredited by Wallonia or one of the 13 research centres associated to the other higher education institutions (*hautes-écoles*) of the French-speaking Community of Belgium. The centre should provide an estimate of the cost of the services requested. The centre should assist the company in every step of the procedure. The number of vouchers per service is calculated on the basis of an estimate provided by an accredited research centre. The same company can benefit from a maximum of 40 technology vouchers per calendar year, corresponding to a total value of EUR 20 000 for a limited expenditure of EUR 5 000, and the beneficiary company cannot hold more than 40 vouchers simultaneously.

*Source*: European Policy Trendchart, *http://proinno.intrasoft.be/index.cfm?fuseaction=wiw.measures&page=detail&id=-1659&CO=2*, *www.ct.innovons.be*.

### Box 6.22. **Innovation vouchers for SMEs: Baden-Württemberg (Germany)**

In 2008, Baden-Württemberg became the first German region to issue innovation vouchers to SMEs with fewer than 50 employees. Innovation vouchers were designed to strengthen SME capacity for innovation and growth. SMEs in many different sectors are eligible, including those in: trade, small industrial supply, business-related services in the health sector, information and communication technology, renewable energies, nanotechnology and other promising sectors. These innovation vouchers support SMEs without own R&D resources, allowing them to make use of R&D services for product innovations, service innovations and process innovations. The vouchers have a value of between EUR 2 500 and EUR 6 000 each and can be used to purchase R&D services. The sources come from companies across Europe. Baden-Württemberg has set aside EUR 3 million for the period 2008-2010 for its innovation vouchers scheme. Following the completion of the pilot project (in 2010), the instrument will be revised and it is likely to be included as part of a longer-term programme of support measures targeting SMEs in the region.

*Source:* Regional Innovation Monitor, *www.rim-europa.eu*, *www.wm.baden-wuerttemberg.de/sixcms/detail.php/173256*.

A recent study that surveyed 23 regional and national schemes in the EU found the following commonalities:

- **Application process:** typical applications are approximately five pages and the approval is given within two or three weeks. The issuer, usually a regional or national body working with industry and business development, handles applications for the innovation vouchers. For example, in Ireland, vouchers are issued by Enterprise Ireland, in the United Kingdom's North West region, businesses apply to the North West Regional Development Agency, and in Finland, the state-run innovation agency Tekes controls the vouchers.
- **Service providers:** private service providers are not included in any of the assessed schemes, unless the vouchers were only focusing on R&D. The service providers are therefore either public or public-private knowledge institutions.
- **Eligible services:** design, client involvement in product development, inward technology transfer, innovation management, business process engineering and market studies belong to the most common eligible services identified (including also in some cases, intellectual property management).
- **Voucher size:** voucher values vary from EUR 500 in the Belgian province of Wallonia to EUR 25 000 in Portugal. The value is generally from EUR 3 000 to EUR 5 000 for those schemes without own contributions from companies and from EUR 8 000 to EUR 13 000 for those where there is a financial contribution from the SME.

Variations across EU programmes concern eligible expenses, target sectors or types of providers, and level of SME co-financing. Some schemes are more restrictive with respect to eligible funding, such as in Ireland and the West Midlands, where eligible and non-eligible activities (as for instance, software or equipment purchase, intellectual property protection, design and production of advertising materials) are very well specified. Some programmes are highly specialised, such as in Manchester (United Kingdom), where there is an innovation voucher scheme for firms to work with local companies on design and creativity. The eligibility of service providers varies from scheme to scheme: half of the analysed schemes allowed foreign service providers, three of them also allowed service providers from neighbouring regions and three others were limited to service providers from the region. France allows firms to choose knowledge providers from both the public and the private sector, domestic or foreign. Many schemes do not require co-financing from the applying company, but others require up to 50%. Current testing of new voucher programmes includes many that are sector-specific (eco-innovation, knowledge-intensive services, innovation management and cluster co-operation).

### *Success conditions and impact*

Although the innovation voucher scheme is a relatively new instrument, experience confirms positive results which are likely to contribute to their increased use by regions. Their direct applicability and bureaucratic simplicity constitute an effective means of raising awareness in traditional SMEs. Innovation vouchers are found to stimulate innovation activities in SMEs not previously innovating and strengthen SME ties with RTOs and other knowledge providers.

Only a few studies and reports assessing the impact of innovation vouchers on knowledge diffusion and innovation in SMEs have been released to date. The evaluation of the Dutch voucher system proved that innovation vouchers make a valuable contribution to the interaction between SMEs and knowledge institutions and contribute to an easy accessibility and wide reach (Netherlands Bureau for Economic Policy Analysis CPB, 2006). The study showed that a significantly larger percentage of companies in the control group (that proposed assignments but did not use a voucher) had perceived the contribution made by knowledge institutions as valuable (Cornet, M., B. Vroomen and M. Van der Steeg, 2006). However, this reference group issued a different type of assignment (issued and completed earlier, more extensive) and was motivated to do so, which might be the reason for the difference. It may be that the result of this assignment had already been implemented or processed (incubation effect). This proved that the voucher is certainly not the only instrument for requesting the services of RTOs.

More recently, an evaluation of the Scottish innovation voucher scheme has concluded that from the SME perspective, the scheme is supporting new, formal R&D and consultancy relationships (Scottish Funding Council, 2010). The evaluation showed that the established projects have met the expectations of companies, and that relationships between SMEs and the consultancy would either have not happened or would have happened at a much slower pace or smaller scale. Companies also pointed out that they prefer funding to be channelled through their academic partner, thereby avoiding additional administration. Academics and commercialisation staff were also supportive of the scheme and believed that the programme was leading some academics to work for the first time with SMEs, establishing new R&D and consultancy relationships with companies. Academics also reported additional benefits from their involvement in a project on their teaching and research activities. For SMEs, too, evidence has shown both financial and non-quantifiable benefits from supported projects. In Finland, a study showed that two out of three participating companies had never used any outside expertise in their innovation process before using vouchers (Potts and Morriso, 2009). Moreover, a large proportion continued their co-operation with the academic institutions even after the vouchers had been used. The participants of the Baltic Dynamic conference in September 2010 in Riga recommended seven principles and policy recommendations for the design and management of innovation vouchers (see Box 6.23).

### Box 6.23. **Riga Declaration: realising the full potential of innovation vouchers programmes**

1. **The primary objective of innovation vouchers is strengthening the innovation capacity of SMEs**, by supporting them in the best possible manner to build new knowledge networks or to benefit from them. Innovation vouchers are demand-driven innovation support measures and should therefore be defined and implemented in a way that serves practical needs of SMEs. Innovation vouchers can be instrumental to better link SMEs with all forms of knowledge and creativity that are supportive to innovation.

2. **Innovation vouchers should support all forms of innovation.** This calls for providing access to innovation experts from diverse fields of expertise; the definition of eligible service providers should be based on transparent criteria that promote competition and support the further implementation of an internal market for services. This could be supported by commonly agreed definitions of innovation support services concepts that would facilitate their mutual recognition by innovation voucher programmes from different member countries.

**Box 6.23. Riga Declaration: realising the full potential of innovation vouchers programmes** *(cont'd)*

3. **The administrative costs of implementing innovation voucher schemes should be kept as low as possible.** The administrative procedures and control mechanisms should be proportionate to the size of the innovation vouchers and continuously be benchmarked against the "best in class".

4. **Innovation vouchers schemes should be the subject of regular impact assessments.** Main impact indicator should be the increase of the innovation capacity of SMEs, for which specific targets should be set in advance, depending on the scope and objectives of the innovation voucher schemes.

5. **Innovation vouchers schemes should be implemented at local, regional and national level**, thus fully taking into account the subsidiarity principle. The European level is encouraged to develop with national and regional entities a voluntary collaboration and brokerage framework for innovation voucher programmes that aims at making excellent knowledge, skills and innovation support services from both public and private service providers across Europe more effectively accessible for SMEs.

6. **Innovation voucher programmes have the potential to raise the quality of innovation support to SMEs.** New and better approaches to innovation support should be developed and tested through European pilot projects and rolled out at local, regional and national level as widely as possible. In order to speed-up the implementation of better practices in support of innovation, new forms of policy coordination between the different policy levels may be considered.

7. The **European Commission, member countries and regions are invited to consider the wider use or promotion of innovation vouchers** wherever possible, with the objective to support all forms of innovation more effectively and cost-efficiently and to reduce the gap between innovation leaders and those still lagging behind.

*Source:* European Commission (2010), *Riga Declaration*, Brussels.

A main risk in the design of innovation vouchers is a misallocation of public funds, more likely for those vouchers with higher grant sizes. To maximise impact and reduce potential for fraud, some considerations include:

- **Clarity of services and objectives:** services defined and linked to clear objectives to ensure the expected impact in SMEs.
- **Highly-qualified service providers:** the definition of eligible service providers and mechanisms to avoid fraudulent behaviour of SMEs, especially in those schemes where they could act as service providers, should be based on commonly agreed criteria that promote competition.
- **Success criteria:** finding a good threshold for the maximum support to be granted and an appropriate co-financing rate to ensure that the most interesting projects are financed by the voucher.
- **Target group representativeness:** vouchers need to be targeted to non-innovating SMEs. The scheme should not mainly attract large companies or already innovative firms.

- **Voucher quota per firm:** whether a maximum number of vouchers in each round should be issued, to reinforce a permanent behaviour change for SMEs, enabling sustainable co-operation between SMEs and RTOs.
- **Marketing:** it is important for RTOs to proactively stimulate the use of vouchers. The actual impact that such schemes may have depends on the implementation mode, e.g. how the vouchers are publicised or what supporting guidance and brokerage is put in place to help firms find knowledge providers.
- **Broaden success assessment to secondary effects:** the success of the scheme must be assessed from a broad perspective. Co-operation is not only restricted to contract research, it should help to broaden the scope of interaction and measure secondary effects that are influencing innovation, such as staff mobility, contact between SMEs and knowledge institutions, and R&D performance**.** Innovation vouchers should be subject to regular impact assessments. A main impact indicator should be the increase of SME innovation capacity, for which specific targets should be set in advance, depending on the scope and objectives of the innovation voucher scheme.
- **Low administrative costs:** the administrative procedures and accountability mechanisms should be proportionate to the size of the innovation vouchers and be benchmarked against the "best in the class". The voucher itself is in most cases only the starting point and the innovative actions often need further support for market entry or similar activities.

### *For further reading*

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European Commission (2008), "Good Practices Identification – Advice for Transferability", Innovation Vouchers Enterprise Ireland.

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European Regional Innovation Monitor, *www.rim-europa.eu*.

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NV Industriebank LIOF (2004), *Innovation Voucher Benelux Middle Area Project Proposal*, *www.kennisvoucher.nl*.

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## 6.6. Mobility grants and talent attraction-retention schemes

### *Definition, rationale and objectives*

The mobility of skilled human capital is a complex phenomenon and an important policy issue in most OECD member countries. That mobility is determined by market forces (attractiveness of certain places), research policy (specific incentives and regulations), history (affinity between countries) and immigration policy, and which involves different types of movements (European Commission, 2009).

In the workplace, knowledge flows through a variety of mechanisms, among which the labour mobility of highly skilled personnel is fundamental. Labour mobility can refer to the change of location between employers (job-to-job mobility); between occupations and steps on the career ladder (occupational mobility); between different types of contracts; and in and out of employment (employment mobility) (Danish Technological Institute, 2008). At the firm level, knowledge is shared with colleagues, especially those in close contact. Knowledge also is shared with people and organisations in geographic proximity (knowledge spillovers) and can contribute to local concentrations of activity.

A second type of mobility refers to education mobility, the most important in quantitative terms. This kind of mobility cuts across different fields: vocational training; adult learning; and mobility of researchers and new graduates from higher education institutions to industry and the public sector. Such researchers can bring with them updated scientific and technological knowledge, promoting a higher level of competence in the host institution. International student mobility increases human capital, as students access new knowledge and develop linguistic skills and intercultural competences. Therefore, its enhancement and qualitative improvement plays an increasingly important role in the modernisation of education and training systems worldwide.

While the above types of mobility may or may not imply a location change, this section primarily examines geographic mobility (see the typology in Table 6.7). Programmes to support geographic mobility include student exchanges as well as mobility grants and attraction-retention schemes for researchers and other skilled employees. A further distinction can be made between outgoing schemes (i.e. those which provide support to the mobility of nationals or resident professionals to travel and work in other countries) and incoming schemes (i.e. those designed to attract foreign professionals to visit/work in the country).

The rationale for mobility grants and attraction-retention schemes is that mobility of people is one of the important mechanisms of knowledge transfer for innovation and growth. These "spillover agents" transfer valuable knowledge from one region to another, and contribute to the upgrading of regional knowledge pools by means of their mobility, placing regions or national economies on a higher growth path (Doring and Schenellenbach, 2006). A knowledge-based society relies on highly qualified people in all sectors of the economy and society, not only for high-technology sectors and research. This growing intensity of knowledge means that all industrialised countries have a greater need for highly-skilled personnel who are able to access, understand and use knowledge for technological, economic and societal development (OECD, 2008b). For receiving countries and regions, the inflow of talent has potential positive effects such as: increased R&D and economic activity; improved knowledge flows and collaboration with countries of origin; increased enrolment in graduate programmes; and potential firm and job creation by immigrant entrepreneurs. International talent attraction helps embed regions in international knowledge networks.

Highly skilled individuals, workers and students, are considered to be key drivers of innovation and economic development. The concept of “creative class”, introduced by Richard Florida, highlights their economic function to create new ideas (technology and creative content). It includes a diverse range of professions such as scientists, engineers, artists, musicians, designers and other knowledge-based professionals (Florida, 2002a). Such creative people are deemed key drivers of innovation and economic development in post-industrial cities, regions and countries. The creative class is highly mobile; therefore regional policy is important to influence their location decisions.

Future demographic challenges and the consequent labour shortages are another important rationale for these talent attraction and retention schemes. Apart from the importance of knowledge transfer**,** demographic and migration trends represent major challenges for regional development policy, where striking regional differences exist. Important local labour shortages can emerge as a consequence of ageing and significant out-migration. And while regional unemployment might decrease in the short term through out-migration, employment growth and productivity can suffer if those leaving are the most talented, educated and entrepreneurial (i.e. brain drain) (Brezzi and Piacentini, 2010). For these reasons, many countries and regions are actively promoting strategies to attract high-talent personnel.

There are substantial obstacles to attracting talent. Regulations regarding visas and residence permits for students and workers restrict international inflows. Another barrier is financial considerations, as high-skilled foreign migrants may be unclear if they can fund their living expenses plus the extra costs of being abroad. Financial assistance schemes in many OECD member countries are still insufficient to meet needs in terms of availability or timing of payment. Researchers in the early stages of their careers are particularly affected by financial obstacles as they lack the experience, networks, economic safety and other qualities upon which more senior researchers often can rely. Language presents a further barrier.

Training and mobility of researchers is also a longstanding and rapidly expanding priority within the OECD member countries. Many schemes are targeting the attraction of both young and more experienced researchers through financial incentives (e.g. PhD grants and fellowships, postdoctoral fellowships, research grants) and other non-financial incentives (e.g. tax incentives, entrepreneurship training programmes). Moreover, there exist instruments to reverse brain drain and promote the reintegration of highly qualified researchers who have been working abroad (see examples in Boxes 6.24, 6.25 and 6.26).

Support for talent attraction and retention is also part of the supranational policy portfolios. Some of the most well-known mobility programmes at European level are Socrates, Leonardo da Vinci and the Lifelong Learning Programme including Erasmus and Tempus. The ERA Mobility Strategy (2001) and several related programmes aim to reinforce the attractiveness of conducting research in Europe. Marie Curie Actions, for example, give financial support for mobile researchers (all career stages) and host institutions so that both benefit from international research and collaboration with industry. Actions also include re-integration of the researcher upon return to country of origin. The approach evolved from one of mobility fellowships to a more comprehensive system of stimulating researcher career development.

Table 6.7. **Examples of mobility schemes for attraction-retention of talented people**

| | |
|---|---|
| Career development | Supporting PhDs: IWT postgraduate grants in Flanders (Belgium), Young talent in Bulgaria |
| | Recruitment of highly qualified workforce: attraction of new highly skilled workforce in Latvia, doctoral grants in Portugal |
| | Nourishing entrepreneurship (job training): spin-offs in Wallonia (training future managers of companies or encouraging university researchers to develop a business plan); Schlumberger in France (offers budgets of EUR 25 000 to EUR 100 000 to company researchers to be spent in research consultancy work; or extraordinary professors (*bijzondere hoogleraren*) in the Netherlands (doctorates coming from industry and are employed to work for the university) |
| Inward mobility | Return of "talent" schemes: the Italian "*Rientro dei cervelli*"; the Dorothy Hodgkin Postgraduate Award Scheme in the United Kingdom; or the "Back to Belgium" Programme |
| | Fiscal incentives: knowledge migrant scheme in the Netherlands; simplification of visa procedures in Poland; Denmark's "Taxation of the Salaries of Well-paid Foreigners and Foreign Researchers"; the research tax credit in France |
| Outward mobility | Grants and loans: Rubicon Programme in the Netherlands (grants for inward and outward mobility); in Spain, grants for the mobility of researchers from Canary research centres |

### Box 6.24. **Research grants to support people mobility: Piedmont (Italy)**

The programme of Piedmont implements the 2006 national law, entitled "Three-year Programme" (Law No 4/2006 Art. 5). According to the law, a university may, within certain budgetary and administrative conditions, confer grants for research activity. Based on this law, on 30 July 2007, an agreement was signed between the Region of Piedmont, the University of Turin, Torino Polytechnic, the University of Eastern Piedmont, and the University of Gastronomic Sciences to develop a research and higher-studies system. The agreement foresaw the launch of activity in four key areas:

- **Containment of brain drain:** humanities and social sciences are given priority with a specific budget. 50% of the annual cost of the grants will be covered by the region of Piedmont for a maximum grant amount of EUR 22 000.
- **Repatriation of Italian researchers:** for researchers working in schools and research centres in and outside of Europe, a co-financing grant of EUR 30 000 for a two-year period is available.
- **Attracting foreign researchers:** an annual grant of EUR 35 000 for those who intend to work in a Piedmont university lab.
- **Attracting Italian or non-Italian visiting professors**: for researchers currently working at schools and research centres outside of Italy that develop activities consistent with those of the Piedmont host institution. The six-month contracts are co-financed by the region and granted to Italian and foreigner teachers who are already firmly committed to a university or research centre abroad.

By 2009 all partners had announced and granted support in all the above-mentioned lines of action. For instance, in 2008 the University of Turin announced 160 grants (out the 335 allocated in 2009 for the first line of action, brain drain) across 16 research areas for a total of 282 projects.

*Source*: Piedmont region website *www.regione.piemonte.it/innovazione/ricerca/attivit-e-progetti/risorse-umane/assegni-di-ricerca.html.*

### Box 6.25. Exchange for persons of Japanese descent abroad: Fukuoka (Japan)

With the purpose of aiding emigrants from Fukuoka, the Fukuoka International Exchange Foundation with support from the Overseas Fukuoka Kenjinkai endeavours to provide international exchange between Fukuoka region and the emigrants' respective countries.

**Fukuoka Prefecture Immigrant Youth Exchange Student Acceptance Programme:** this programme accepts descendents of Fukuoka immigrants to study in a university in Fukuoka Prefecture for one year. In addition to acquiring knowledge and skills of their specialisation, the aim is that these students will interact with Fukuoka residents and learn about Fukuoka's culture and society.

**Fukuoka Prefecture Immigrant Youth Short-term Acceptance Programme:** this programme invites young descendents of Fukuoka immigrants to learn about Japan's history, culture, and industries, and to foster the growth of youth who will become the core of exchanges between their home countries and Japan.

The 2008 total budget was JPY 1.9 billion (EUR 17 million), of which 80% was provided by the Fukuoka prefectural government; 4% from the city government and 16% from private companies. The main outcomes of this programme per the most recent evaluation were:

- efforts for developing relationships with local authorities in Korea, Thailand, and Vietnam;
- deepened mutual understanding with Korea through student exchanges;
- advanced personnel exchanges and support for the Fukuoka Prefecture Student exchange centre;
- 25 scholarships for students;
- support to *Nikkei jin* (Brazilians/South Americans with Japanese ancestry), including annual scholarships to nine students (based at Kyushu university, Kyushu Sangyo University, and Kyushu Women's University);
- frontier programme (exchange programme): five young students were sent to Mexico.

Similar to the Fukuoka International Exchange Foundation Programme, the Hundred Talent Programme has been implemented in China since 1994.

*Source*: Foukuoka International Exchange Foundation *www.kokusaihiroba.or.jp/j00top/index.htm%29*; *www.caspe.ac.cn/*; can be found in the 2008 Annual Report.

**Box 6.26. Vienna Research Groups for Young Investigators: Vienna (Austria)**

Vienna Research Groups for Young Investigators is an instrument jointly designed by the City of Vienna and the Vienna Science and Technology Fund to promote talent in scientific fields of importance to Vienna. The main objective is to attract top talent to Vienna and build long-term relationships with local research organisations. As a thematic programme, it concentrates on projects and endowed chairs in the research fields of biology, biotechnology, medicine, veterinary medicine, pharmacy, bioengineering and related fields. The programme addresses universities and research institutions that seek to attract excellent young researchers to Vienna for founding their own research group. The measure is mainly two instruments: endowed professorships and financial support for the founding of junior research groups. The programme launched its first call within its life sciences programme March 2010. This call was targeted to Vienna-based research institutions that intend to hire excellent young researchers from abroad for the set-up and management of an independent Life Sciences Research Group.

*Source*: Vienna Science and Technology Fund, *www.wwtf.at.*

### *Evolution over time and variety*

As economic activity has become more globalised, highly skilled individuals have become increasingly mobile. Mobility has hence become a prioritised focus of science, technology and innovation policies. Many sectoral or regional innovation strategies include a goal to increase talent attraction.

Nevertheless, regional, national and international mobility of labour is not a new phenomenon. Historically, the diffusion of technologies has owed much to talent mobility. Countries and regions have taken differing approaches to attract and keep skilled workers, as for example the subsidies provided by Louis XIV during the 17$^{th}$ and 18$^{th}$ centuries to attract skilled artisans.

However, it was not until the mid-20$^{th}$ century when OECD member countries began to undertake notable policy action, including immigration policies. In general, Europe has been less ambitious in the competition for global talent compared to the United States, Canada or Australia. Contrary to the United States or Canada, which launched their first legislation in favour of highly-skilled immigration as early as in 1952 and 1967 respectively, European states and the EU started to set policy actions in favour of the highly skilled only recently. One of the first countries to develop a support scheme for mobility in Europe was Sweden, which in 1955 set a system of subsidies to promote the geographical, occupational and sectoral mobility of labour. On the other hand, other EU countries did not start to develop such instruments until the 1980s and 1990s.

Universities or research institutions have increasingly promoted mobility support schemes. Within the EU, the number of mobile students still remains very low, even though it has been increasing in the last decade. It is for that reason that many support projects and activities that foster exchange and mobility across education and training systems have recently flourished. The range of EU-level mobility programmes has expanded in the last decade, both in terms of variety and in intensity. During the last decade, the EU and several member countries have launched policy programmes with the aim to promote scientific careers, in encouraging skilled and highly skilled trained people to stay in their region as well as to attract foreign students to their territories. The European Commission has launched several initiatives since the adoption of the Lisbon

Strategy in 2000. The European Commission initiated the creation of a common labour market for researchers (European Research Area) and a harmonised entry scheme for non-European researchers (scientific visa) to be competitive with the United States in terms of critical mass and labour market size.

Finally, the targets of mobility schemes have recently expanded to include a range of artistic fields, such as fashion and architecture. For instance, the mobility of cultural professionals figures as a strategic objective of the European Agenda for Culture (2007) and in the EU Work Plan for Culture 2008-10. Additionally, with the development of ICTs, new approaches such as e-learning, e-mobility and virtual mobility are being used.

### *Success conditions and impact*

Measuring success and identifying bottlenecks requires an understanding of the range of policies affecting the various forms of mobility. Many factors beyond such policies also affect talent mobility, such as labour regulation, language, fiscal policy, etc.

While mobility of the highly skilled is accepted as a means to diffuse knowledge, there is little consensus among scholars on the exact contribution of different measures of human capital mobility to economic development. This is a consequence of a lack of instruments to measure mobility flows and evaluate the outcome of mobility programmes. While many government agencies publish data on the grants they issue, e.g. on the number of mobile people, the amount they receive, their destination, or on the use of the grant (output), there are limitations in using short-term economic indicators to measure mobility success in terms of input (e.g. mobility funding) and immediate output (e.g. physical movements, new projects or co-productions), rather than assessing longer term outcomes.

Some evaluations have been carried out on EU initiatives. Marie Curie Actions proved successful in increasing international mobility of researchers, particular young research fellows. And most fellows return home after the period abroad bringing with them new learnt skills (Van de Sande, Ackers and Gill, 2005). These exchanges can in turn support international networks of knowledge flows while preventing brain drain.

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## 6.7. Research infrastructure

### *Definition, rationale and objectives*

A number of central governments have used investments in research infrastructure as a tool for regional development. Such investments include new or relocated research labs, the creation of regional universities, establishment of large scale facilities, or even creation of science cities (see section "Science and Technology Parks"). The geography of that investment matters, as it may be centralised in core regions or decentralised across the whole national territory. And the orientation of such research labs towards sharing knowledge with firms, whether national or local, is crucial for regional development. In some federal countries, such as Germany, there has been a wide geographical distribution of research facilities as national and *Länder* governments share responsibilities for research investment. In France, Korea, Spain and the United Kingdom, for example, national research infrastructure is more centralised, even if in some cases it has been subject to considerable reconfiguration in recent years.

Benefits to a region of research infrastructure include:

- direct economic multiplier effects through above average salaries and local procurement;
- the attraction of a pool of high-quality labour for other research employers;
- exchange of informal knowledge flows to local firms, especially where a lab directly supports a particular sector or cluster;
- desire for firms to have a close relationship with government labs given their role in influencing national procurement decisions;
- enhanced access to knowledge of new standards and regulations emanating from government labs.

Five different types of policies have been used with respect to the location of research infrastructure in regions:

- policies to relocate public research labs outside of the capital region;
- major research infrastructure such as synchrotrons, research reactors or radio telescopes which are often of international significance;
- new universities in peripheral regions to supplement or compensate for low levels of R&D as well as strengthening human capital;
- regionally based centres for industrial technologies or centres of expertise to support industrial innovation;
- new agglomerations of R&D in the form of science cities (see section "Science and Technology Parks").

### *Large research facilities*

Several countries are relocating public labs outside capital regions with observable benefits for the country and region. Grenoble (France) is a case of decentralisation outside of Paris to promote a strong research and development centre. Grenoble has experienced significant economic growth following a steady period of national R&D investment in the region. With re-unification, Germany has invested in new research infrastructure in the former East Germany, an area of shared competence between the federal and *Länder* governments. There has been some encouragement of R&D in EU regional policy for the less favoured regions, but mainly the emphasis has been on the establishment of new regionally oriented labs rather than outright relocation.

The most ambitious attempts in research infrastructure relocation in support of regional development seem to be in Asia. The consequences of excessive centralisation in mega-cities have prompted a comprehensive review of the location of research infrastructure. In the case of Korea, the overwhelming concentration of research and economic activity in Seoul is recognised as contributing to severe congestion diseconomies as well as hampering the development of other regions. Accordingly, the government is seeking to decentralise public R&D to a series of "innovative cities" to be constructed near existing cities in each of the regions. In each case, the proposal has been to relocate a cluster of government research institutes to form the core of an innovative city's development, typically with around 3 500 employees, which will also attract a range of related firms and activities. Some cities have a particular focus that links with local industrial clusters, therefore reinforcing economic potential. The timeframe for this development is over ten years, and initial construction has commenced in some of these cities. Further examples of R&D infrastructure relocation can be linked to science city strategies such as Tsukuba in Japan.

Throughout OECD member countries, local and regional governments are competing for hosting major international research infrastructure. The competition tends to be concentrated among regions with the strongest knowledge base, but peripheral regions are also competing in expectation of spillovers for their development (see Box 6.27).

#### Box 6.27. **Regions competing internationally for large research facilities**

A number of countries were competing to host the European Spallation Source. Sweden, Hungary and Spain were the primary bidders. Given the economic benefits of hosting this project, and when it became clear that Sweden (Lund) was the front-runner, the Spanish government agreed to support that site in return for a EUR 180 million laboratory in Bilbao which will undertake testing services, technology design and software development for the main site in Lund.

Another competition for a major facility is the Square Kilometre Array (SKA) radio-telescope, taking place between Australia and Southern Africa after four other bidders either dropped out or were eliminated from the shortlist. The SKA is an unusual facility in that its central facility has to be at least 550 kilometres from an urban centre, with the radio dishes spread out over a vastly greater area. All states in Australia and several countries in Africa bid. Western Australia sees the prospect of the AUD 3 billion investment as having a transformative effect on science in Perth if the bid is successful.

*Source:* Charles, D. and E. Uyarra (2010), "Practical Benefits of Innovation-related Policy Instruments at the Regional and Local Level", background paper for the OECD.

### *University research infrastructure*

Many countries have research-intensive universities gathered around a few large urban cores or traditional university cities. This is often the case where national governments hold the primary responsibility for regulation and funding. In higher education systems where state governments were historically responsible for universities, such as Australia or the United States, there has been a more decentralised model from the start. The rapid expansion of higher education in the 20th century has led to a wider distribution of new universities in regions previously lacking them, including in a range of smaller towns and cities, and even in more rural areas. This spatial decentralisation of universities has been particularly strong in the period since the 1960s, but for some countries with greater impetus in the 1980s and 1990s (Box 6.28).

#### Box 6.28. **Regional decentralisation of universities**

- **Germany:** Universities are widely distributed across the regions, with a key principle being equity of access. A large number of new institutions were established in the 1960s, especially in the Ruhr sub-region, which previously lacked a university.
- **Spain:** There has been massive growth since the 1980s, with many new institutions in regions previously lacking universities, especially after the transfer of powers relating to universities from the national to regional governments.
- **Finland:** Establishment of universities in the rural areas to the north and east of the country since the 1960s, with a specific mission of encouraging greater access to higher education.
- **Greece:** Historical over-concentration in Athens, but gradual process of decentralisation with small new institutions in almost every region.
- **Ireland:** Concentration in Dublin, but since the 1960s expansion in the regions with new universities and the upgrading of existing institutions.
- **United Kingdom:** massive increases since the 1960s with several phases of expansion, including the re-designation of polytechnics as universities. Universities are now widely distributed but are highly diverse in character leading to variations in orientation in different regions.
- **Australia:** Growth has been accompanied by the emergence of new universities in rural areas, and by a proliferation of campuses, the latter often targeted at either raising participation in rural areas, or engaging in competition for students in the cities.

*Source:* Charles, D. and E. Uyarra (2010), "Practical Benefits of Innovation-related Policy Instruments at the Regional and Local Level", background paper for the OECD.

The importance of universities for regional development is linked to the trend of a "third mission" – service to society in addition to education and research. In this context, national and regional governments have sought to encourage universities to support SMEs, usually within the region, and to address regional economic disparities through innovation programmes. National funding for regional innovation linkages with universities falls into three categories:

- national programmes to encourage innovation involving collaborative activities and implementation in each region;
- national strategic developments in selected regions only, to foster centres of excellence, often in disadvantaged areas; and
- national funding for regionally-initiated schemes.

In a few cases, national governments have initiated large strategic projects associated with universities. Examples include the National Technology Park at Limerick in Ireland (Charles *et al*., 1995), or the research institutes and science parks in Crete (Greece) (OECD, 2005). These large-scale developments attached to universities are intended to quickly build critical mass and thereby accelerate the potential offered by the presence of the university. Limerick has been more successful than others due to the attraction of significant foreign direct investment as well.

### *Regional level initiatives*

Regional level initiatives to develop research infrastructure include both basic research and technology centres approaches (Box 6.29). Many regions have developed sectorally focused centres since the 1980s, either building on established foundations or developing completely new initiatives. Some Spanish regions have been particularly active in building this infrastructure. The Basque Country's STI policy has provided continued public support for networks of private technology centres. They build on older sectoral centres (e.g. industrial technologies, automation, robotics and materials). These centres are partly funded by the regional government but also provide services to firms in return for membership fees and consultancy payments. Over time, they have become more research-intensive and are competitive in attracting national and international research programme funds. The Research Centres of Catalonia, a network of over 30 centres, have been created to achieve the region's science goals. They were established as private entities outside of universities, albeit often associated with them, to ensure greater accountability for results. These centres cover areas important for the region's sectors requiring science-based development (such as biotechnology) as well as the social sciences. In Germany, the Fraunhofer Institutes provide advice, research and support to industry. They are nationally distributed, funded in part by *Länder* governments as well as the federal government.

#### Box 6.29. **Regional centres for industrial technologies in North East England**

In North East England, the regional development agency's (RDA) response to wider debate on regional science and innovation was the "Strategy for Success", submitted to the UK government in September of 2001. The core of the strategy was the formation of a Science and Industry Council (a practice generalised throughout English regions), a regional exploitation agency and five Centres of Excellence, each to be established as non-profit companies (life sciences, nanotechnology, new and renewable energy technologies, digital technologies and process industries). Those sectors were chosen for a mixture of novel technologies to the region and existing regional industrial and academic strengths. The regional exploitation agency, now known as NStar, was to provide access to finance, proof of concept investment and commercialisation advice and assistance.

Box 6.29. **Regional centres for industrial technologies in North East England** *(cont'd)*

During 2003, the five centres began to develop their own models of operation and to prepare initial business plans. In each case, resources were made available from the region's RDA to build the centres over a five-year period, including capital and research investment as well as recurrent costs. Each of the centres was required to plan for self sufficiency from commercial and investment income at the end of that five-year period. Overall, it was estimated that the RDA would invest around GBP 200 million over the 5 years in the Strategy for Success programme, but aiming to leverage a similar level of investment from EU Structural Funds and Framework Programme as well as other national programmes. Each of the centres evolved quite distinct strategies depending on the characteristics of the technologies and sectors they supported, and on the legacies of existing centres and activities they were able to build upon. Some of the centres adopted a virtual model and provided funding for initiatives based in the universities and in industry (notably in biotechnology and IT) whilst in the energy and process industries, the centres invested in their own facilities and laboratories working in collaboration with existing industrial clusters.

*Source:* Charles, D. and E. Uyarra (2010), "Practical Benefits of Innovation-related Policy Instruments at the Regional and Local Level", background paper for the OECD; OECD (2008), *Reviews of Regional Innovation: North of England, United Kingdom 2008*, OECD Publishing, Paris, doi: 10.1787/9789264048942-en.

### *Regional dimension*

The general trends contributing to a greater role for regions in innovation policy have increased the emphasis on regional considerations in the location of public research infrastructure. The devolution of STI policy to regions has resulted in a growing range of regional competences for innovation, higher education and even basic research. Regional governments are more active in lobbying for additional national R&D research facilities, as well as using their own resources. Through Structural Funds, the EU has supported significant upgrading of the technology infrastructure in the regions in partnership with national and regional governments.

The growth of science-based industries has also created windows of opportunity for regions to seek to develop new science and research competence advantages. They are lobbying national governments to host newly created research centres and international facilities, as well as positioning themselves as first movers for new science-based industries. As a result, regions have become much more active in looking to influence and shape the geography of science funding and the location of major science infrastructures with associated regional multiplier effects.

### *Evolution over time and variety*

Since the 1940s, OECD member country governments have invested heavily in national research organisations. The purpose of such bodies has been varied, some to support government policy, some for blue sky research, and only some for economic development purposes. Typically these investments have belonged to national government ministries and agencies. Some of the oldest of these research institutions date back even further and have their roots in defence research.

Location decisions have been based on national science policy rather than regional objectives. Outside of federal states, national governments tend to centralise R&D labs to manage them more effectively. In many countries research has traditionally been concentrated in the national capital region (France, Italy, Japan, Korea, Spain, United Kingdom, etc.)

However this tendency has been challenged in recent years following the recognition of the benefits of research and innovation for regional development. The continued growth of high-technology industry near to public research facilities and universities, and the emergence of some key centres as the home for nationally significant high-tech clusters, has changed somewhat the location agenda.

### *Success conditions and impact*

A central question regarding location of public research infrastructure is whether greater R&D investment in lagging regions is able to stimulate innovation and economic development. Whilst investment in R&D infrastructure will undoubtedly have a direct economic impact through its employment effects and any capital investment, will it be sufficiently integrated into the regional innovation system to have a spillover effect?

The answer depends in part on the appropriability of knowledge produced by R&D and the minimum threshold or scale for efficient R&D performance. In areas of weak absorptive capacity, establishing research labs or research-oriented universities can be risky ventures as industrial links may be difficult and too slow to develop. The region needs to have sufficient absorptive capacity to support spillovers. And from a national perspective, the question is whether the location of R&D infrastructure in a lesser performing region will yield the highest returns to boost national innovation performance. Government responses have been both to propose policies for the decentralisation of R&D, but also to retain some of the benefits of agglomeration by focusing on locations that might have greater absorptive capacity or by creating new agglomerations away from the metropolitan cores.

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# Part II

## *Chapter 7*

# Regions and innovation, country by country

## Introduction

The country profiles present a synthesis of information on innovation-related indicators at the regional level and the governance structure across levels of government for science, technology and innovation policy. They include:

1. A summary of innovation-related indicators according to the information available in the *OECD Regional Database*. The figure shows inter-regional variation across the OECD and the country. For each indicator, the performance of a high and low GDP per capita region within the country is highlighted.
2. A map showing the inter-regional variation within the country according to the categorisation of regions presented in Chapter 1. Regions are classified into three major categories and eight groups according to their production and innovation profile (see Table 7.1 for a description of the categorisation).
3. Two tables containing qualitative information about the multi-level governance structure for science, technology and innovation policy per country. The first table provides information about the administrative and institutional infrastructure for innovation policy in the country, including the relationship between different levels of government. The second table shows the use of different types of policy instruments by level of government. Information was provided by countries in response to the OECD-GOV Survey on the Multi-level Governance of Science, Technology and Innovation Policy (OECD, 2009, see Chapter 3) or by a country expert. Information may have changed since data collection.

Table 7.1. **Categorisation of OECD regions used in country profiles**

| Group type | Main characteristics | Population | GDP | Average GDP per capita |
|---|---|---|---|---|
| | | (% of sample) | | Constant USD 2000 |
| **Knowledge hubs** | | **25.2** | **29.6** | |
| Knowledge-intensive city/capital districts<br><br>(9 regions: Vienna, Brussels, Prague, Berlin, Bremen, Hamburg, London, DC, Korea Capital Region) | These densely populated capital or city districts have high R&D and patenting intensity. The high share of services in knowledge-intensive sectors takes advantage of the highly educated workforce. Due in part to small geographic size and commuting, these regions have on average very high GDP per capita. They also have a relatively high unemployment rate. | 4.9 | 5.1 | 51 065 |
| Knowledge and technology hubs<br><br>(29 regions: 3 Germany, 1 Denmark, 3 Finland, 2 France (including Ile-de-France), 1 Korea, 1 Netherlands, 4 Sweden (including Stockholm), 3 UK, 11 US (including California, Massachusetts, Michigan, New Jersey) | These are the top knowledge and technology regions in the OECD. They have, by far, the highest average levels of R&D and patenting intensity, as well as the share of R&D conducted by business. The industrial structure includes a significant share of manufacturing in high-technology sectors. | 20.3 | 24.5 | 35 729 |

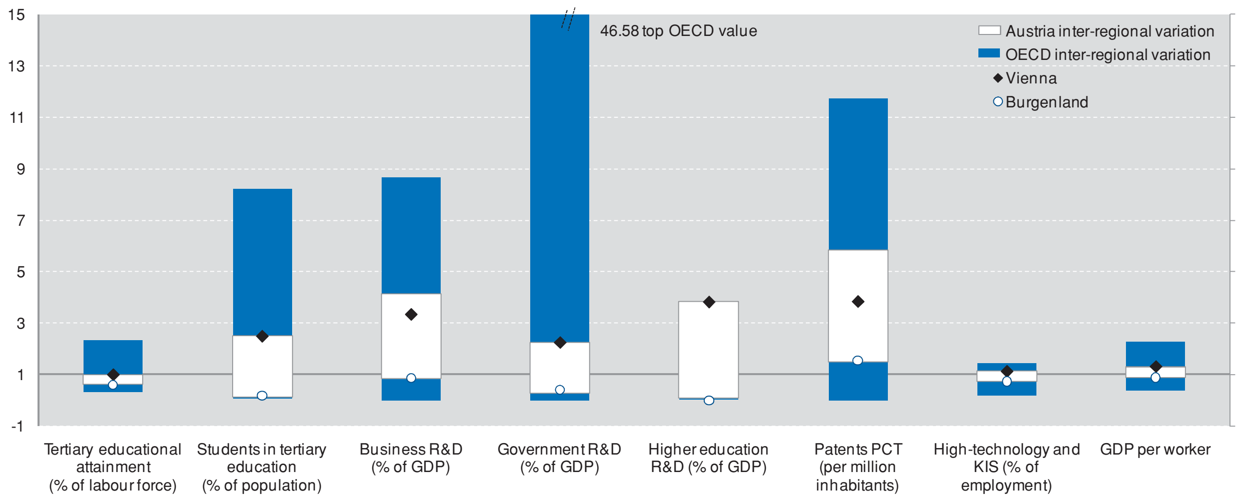
Table 7.1. **Categorisation of OECD regions used in country profiles** *(cont'd)*

| Cluster type | Main characteristics | Population (% of sample) | GDP (% of sample) | Average GDP per capita Constant USD 2000 |
|---|---|---|---|---|
| **Industrial production zones** | | **60.4** | **62.1** | |
| US states with average S&T performance<br>(38 regions: all US) | This group covers 38 US states, generally those which are not Knowledge hubs. They are distinctive relative to regions in other OECD countries given their high wealth levels and above average R&D and patenting intensity. They also have a generally strong share of manufacturing in high- and medium-high-technology sectors, and services in knowledge-intensive sectors. They have a notably less educated workforce than most other Industrial production zone groups. They are also less densely populated than other OECD regions, due in part to the larger spatial scale of US states relative to regions in other countries. | 25.3 | 30.2 | 35 791 |
| Service and natural resource regions in knowledge-intensive countries<br>(28 regions: 4 Canada, 4 Denmark, 1 Finland, 2 Korea, 1 Luxembourg, 3 Netherlands, 7 Norway (including Oslo), 4 Sweden, 1 Slovak Republic (Bratislava region), 1 UK) | These regions are often a second-tier in knowledge-intensive countries. They are generally of small geographic scale and/or less densely populated but with a highly educated labour force. They may derive wealth in part from the high share of employment in knowledge-intensive services, or natural resources, in addition to the more limited manufacturing which is in sectors of lower technology level than other Industrial production zones. | 5.1 | 5.6 | 33 187 |
| Medium-tech manufacturing and service providers<br>(49 regions: 2 Belgium, 2 Canada, 7 Germany, 4 Spain (Madrid, Catalonia, Basque Country and Navarre), 18 France, 1 Greece, 1 Hungary, 2 Ireland, 2 Italy, 2 Korea, 1 Portugal (Lisbon), 7 UK) | These are industrial production regions (manufacturing and services) and some capital regions of middle income countries. While not the global high-technology hubs, they do have a strong medium-low- and medium-high -technology industrial base. They also have relatively high knowledge absorptive capacities, including a significant share of the labour force with tertiary education. | 23.1 | 20.1 | 25 565 |
| Traditional manufacturing regions<br>(30 regions: 8 Austria, 7 Czech Republic, 2 Hungary, 10 Italy, 1 Korea, 1 Slovak Republic, 1 US) | These regions have the highest share of employment in manufacturing, generally in medium-low- and low-technology (traditional) sectors. Business accounts for the bulk of R&D investment. This group is also distinctive for the relatively lower-skilled labour force (lowest share with tertiary education of any group). | 7.0 | 6.2 | 25 686 |
| **Non-S&T-driven regions** | | **14.4** | **8.3** | |
| Structural inertia or de-industrialising regions<br>(38 regions: 4 Canada, 3 Germany, 13 Spain, 1 France, 3 Hungary, 8 Italy, 4 Poland, 2 Slovak Republic) | These regions with persistent "underdevelopment" traps face a process of de-industrialisation or experience structural inertia. They have considerably lower GDP per capita than other groups and the highest average unemployment rate. Values on S&T-related indicators are low. | 9.4 | 5.9 | 19 458 |
| Primary-sector-intensive regions<br>(19 regions: 3 Greece, 1 Hungary, 12 Poland, 3 Portugal) | These Southern and Eastern European regions with low population density have a significant share of their economy in primary sector activities or low-technology manufacturing. They have, on average, the lowest values on S&T-related indicators (R&D, patenting, share of R&D by business). | 5.0 | 2.4 | 13 880 |

*Source:* Ajmone, G. and K. Maguire (forthcoming), *Categorisation of OECD Regions Using Innovation-Related Variables*, Regional Development Working Papers, OECD Publishing, Paris.

# Austria

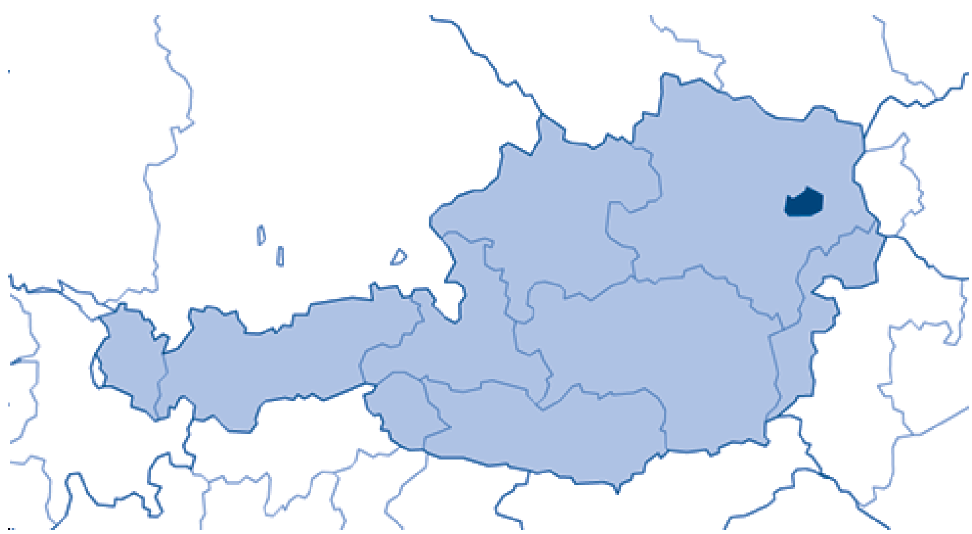
Figure 7.1. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.2. **Categorisation of OECD regions in country**



**Knowledge-intensive city/capital districts:**
Vienna

**Traditional manufacturing regions:**
Burgenland, Lower Austria, Carinthia, Styria, Upper Austria, Salzburg, Tyrol, Vorarlberg

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.2. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 9 *Bundesländer* (states) |
| Country structure | Federal |
| Sub-national share of government expenditure, all functions (2009) | 31.4% (17.3% regional, 14.1% local) |
| Definition of regional role in STI | Constitution |
| Regional role in higher education | Mainly federal responsibility, regions involved in some aspects |
| Formal national-regional co-ordination bodies | Meetings with Ministry of Science and Research and Federal Chancellery with states; self-organising through common practice |
| Regional consideration in national S&T/Innovation Plan | STI Strategy 2020; calls for coherence, alignment across levels of government |
| Example of national policies with explicit regional dimension | 1) Universities of Applied Sciences; 2) clusters; 3) competence centres |
| Example of co-ordination tools | Use of multiple tools, including dialogue and consultation, contracts for specific entities, project co-financing and national territorial representatives |

Table 7.3. **Instruments by level of government**

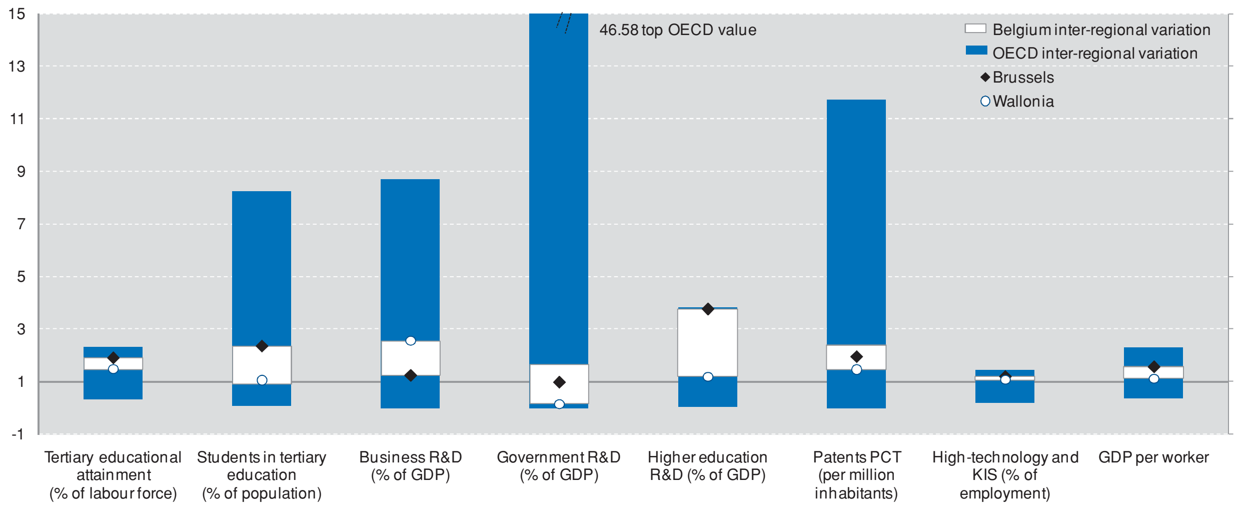
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | X | X |
| Competitive R&D funding by PRCs or HEIs | X | S |
| Public subsidies for private R&D | X | S |
| Tax credits for private R&D | X | X |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | X |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | X |
| Science and technology parks | X | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | S |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | X | S |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | X | X |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | X |
| Innovation awards | X | X |

Notes: PRC=public research centre; HEI=higher education institution.

# Belgium

Figure 7.3. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.4. **Categorisation of OECD regions in country**

**Knowledge-intensive city/capital districts:**
Brussels Capital Region

**Medium-tech manufacturing and service providers:**
Flanders, Wallonia

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.4. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 3 regions |
| Country structure | Federal |
| Sub-national share of government expenditure, all functions (2009) | 36.6%<br>(23.3% regional, 13.3% local) |
| Definition of regional role in STI | Constitution<br>Research policies almost completely decentralised<br>Technology and innovation policies under regional responsibility |
| Regional role in higher education | Communities responsible for higher education |
| Formal national-regional co-ordination bodies | Two commissions for inter-governmental relations also deal with S&T&I: CIS – International Co-operation Commission and the CFS – Federal Co-operation Commission with specialised working groups |
| Regional consideration in national S&T/Innovation Plan | Plans under the responsibility of the regional level |
| Example of national policies with explicit regional dimension | Regions manage programmes |
| Example of co-ordination tools | Consultation |

Table 7.5. **Instruments by level of government**

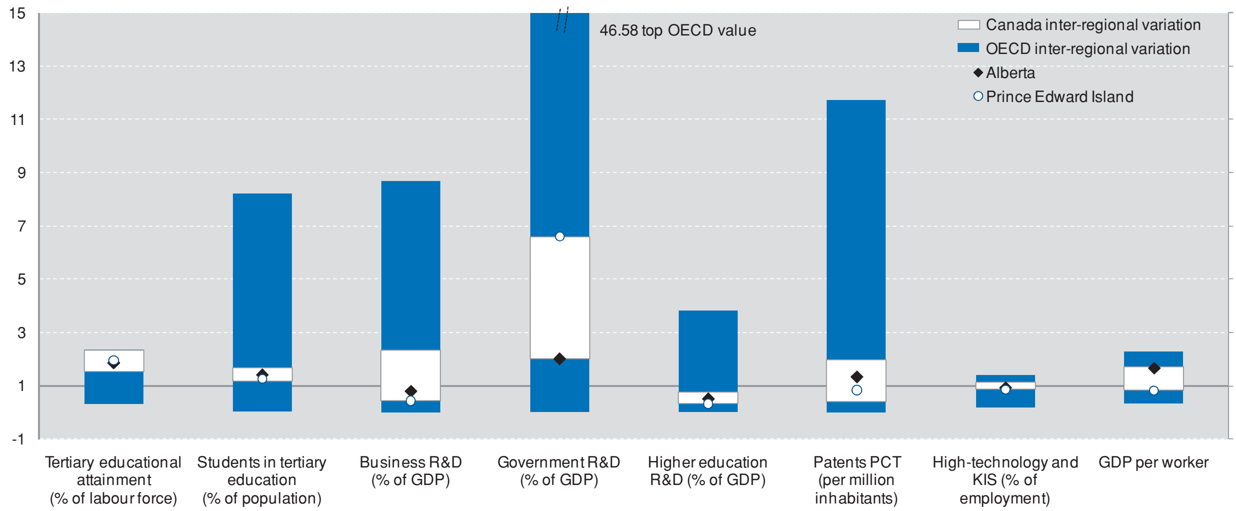
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | X |
| Targeted human resource training (directly, subsidies) | | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | | X |
| Seed funding/projects to start PRCs or HEIs | | X |
| Competitive R&D funding by PRCs or HEIs | X | X |
| Public subsidies for private R&D | | X |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | | X |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | | X |
| Advisory to spin-off and knowledge-intensive start-up firms | | X |
| Other technology transfer centres and extension programmes | | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | | X |
| Branded excellence poles or hubs (label and multiple actors) | | X |
| Multi-disciplinary technology platforms | | X |
| Science and technology parks | | X |
| Incubators for new firms | | X |
| **Financing for innovative firms** | | |
| Public development banks | | X |
| Public venture capital funds or stakes in private funds | | X |
| Guarantees | | X |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | | |
| International trips to develop innovation networks | | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | | X |
| Innovation awards | | X |

Notes: PRC=public research centre; HEI=higher education institution.

## Canada

Figure 7.5. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.6. **Categorisation of OECD regions in country**

**Service and natural resource regions in knowledge-intensive countries:**

British Columbia, Alberta, Manitoba, Saskatchewan

**Medium-tech manufacturing and service providers:**

Quebec, Ontario

**Structural inertia or de-industrialising regions:**

Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.6. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 12 provinces and territories |
| Country structure | Federal |
| Sub-national share of government expenditure, all functions (2008) | 65.1%<br>(45.9% regional, 19.2% local) |
| Definition of regional role in STI | None |
| Regional role in higher education | Provincial responsibility; federal funding sources for research |
| Formal national-regional co-ordination bodies | No formal consultation processes but use of several co-ordination tools |
| Regional consideration in national S&T/Innovation Plan | Mobilising S&T to Canada's Advantage, 2007: recognises the importance of partnership with regions |
| Example of national policies with explicit regional dimension | National Research Council Technology Clusters Programme; programmes promoted by federal regional development agencies (e.g. Atlantic Innovation Fund) |
| Example of co-ordination tools | Regional development agencies (federal entities), contracts, project co-financing, dialogue, consultation |

Note: Many sub-provincial (local) entities are also active in a wide array of these STI instruments.

Table 7.7. **Instruments by level of government**

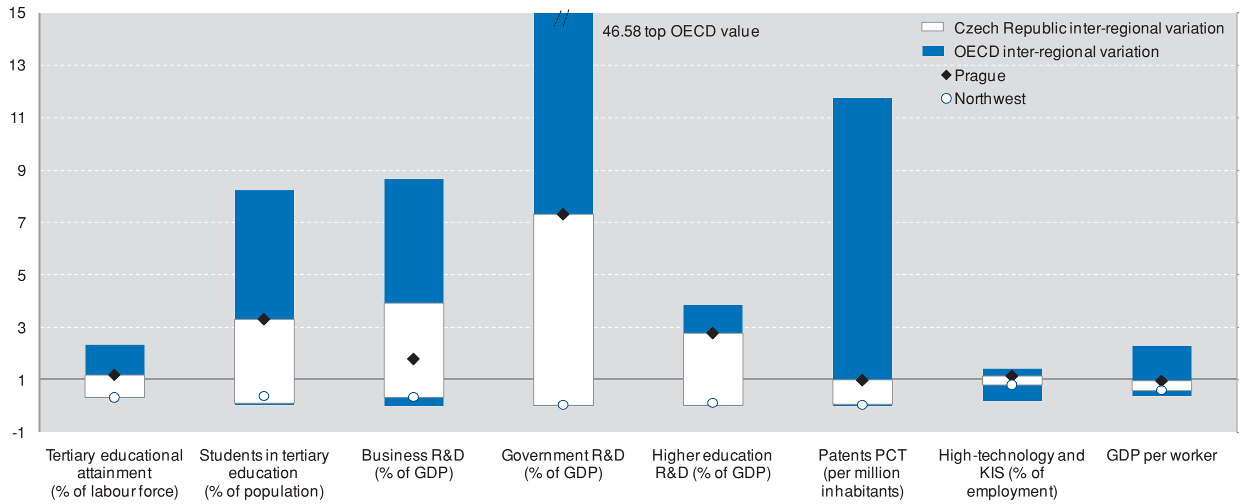
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | S |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | X | X |
| Competitive R&D funding by PRCs or HEIs | X | S |
| Public subsidies for private R&D | X | S |
| Tax credits for private R&D | X | S |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | X |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | X |
| Science and technology parks | X | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | X |
| Public venture capital funds or stakes in private funds | X | X |
| Guarantees | X | X |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | X | S |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | X |
| Innovation awards | X | X |

Notes: PRC=public research centre; HEI=higher education institution.

## Czech Republic

Figure 7.7. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.8. **Categorisation of OECD regions in country**

**Knowledge-intensive city/capital districts:**
Prague

**Traditional manufacturing regions:**
Central Bohemia, Southwest, Northwest, Northeast, Southeast, Central Moravia, Moravian-Silesia

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.8. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 8 *Oblasti* (regions) |
| Country structure | Unitary, elected regions |
| Sub-national share of government expenditure, all functions (2009) | 26.6% |
| Definition of regional role in STI | No formally defined roles |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | Consultation for preparing national plans generally, no STI-specific bodies |
| Regional consideration in national S&T/Innovation Plan | Not a significant consideration in *National Policy of Research, Development and Innovation in the Czech Republic for 2009–2015*; one measure to support establishment and development of RDI infrastructure at the regional level |
| Example of national policies with explicit regional dimension | CzechInvest (under the Ministry of Industry and Trade) supports some STI activity through regional offices or programmes (Klastry-cluster programme). |
| Example of co-ordination tools | Use of a wide range of tools: consultation, dialogue, contracts, project co-financing, national territorial representatives |

Note: Important role of EU Structural Funds for supporting regional innovation strategies and programmes.

Table 7.9. **Instruments by level of government**

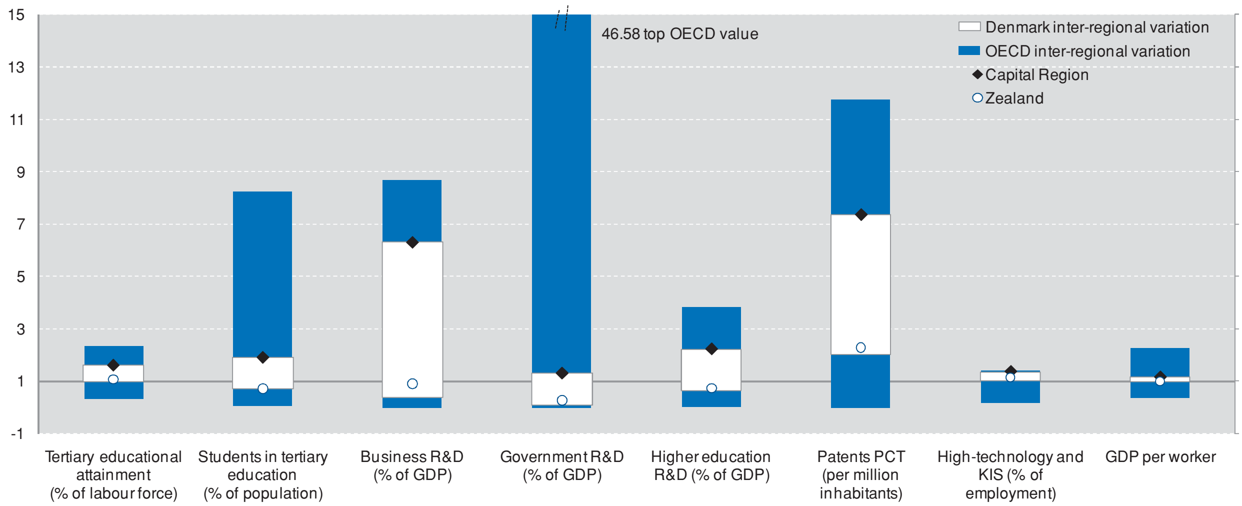
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | X | X |
| Competitive R&D funding by PRCs or HEIs | X | X |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | S |
| Multi-disciplinary technology platforms | | |
| Science and technology parks | X | X |
| Incubators for new firms | | X |
| **Financing for innovative firms** | | |
| Public development banks | X | |
| Public venture capital funds or stakes in private funds | X | |
| Guarantees | X | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | X | X |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | | |
| Innovation awards | | |

Notes: PRC=public research centre; HEI=higher education institution.

# Denmark

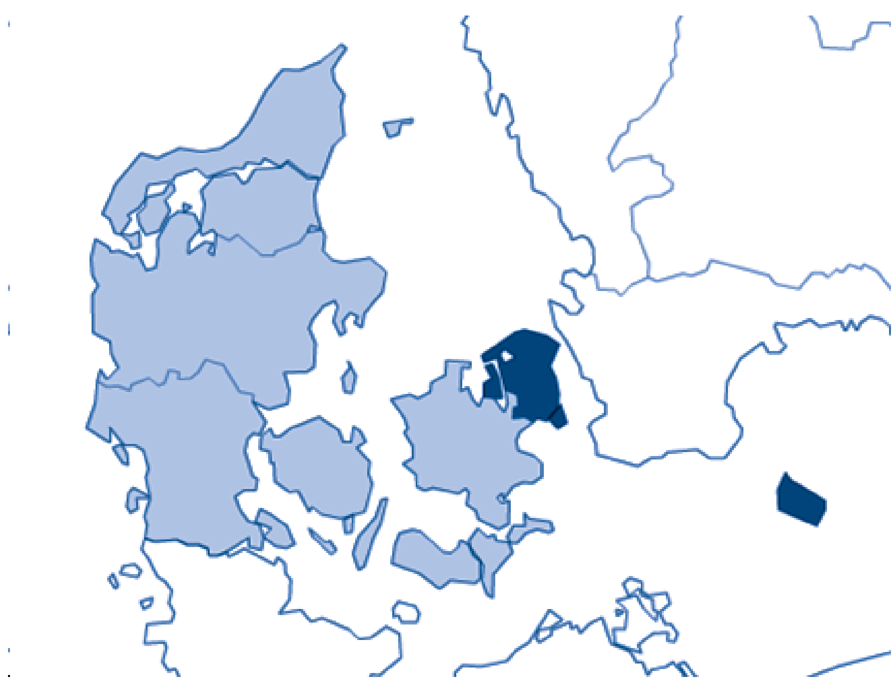
Figure 7.9. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.10. **Categorisation of OECD regions in country**



**Knowledge and technology hubs:**

Capital Region

**Service and natural resource regions in knowledge-intensive countries:**

Southern Denmark, Central Denmark, Zealand, North Denmark

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.10. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 5 *regioner* (regions) |
| Country structure | Unitary, elected regions |
| Sub-national share of government expenditure, all functions (2009)[1] | 63.4% |
| Definition of regional role in STI | Law on Regions |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | Partnership agreements between national government and Regional Growth Fora/Councils on regional innovation and business development |
| Regional consideration in national S&T/Innovation Plan | *Progress, Innovation and Cohesion – Strategy for Denmark in the Global Economy* (2006) takes agreements into account |
| Example of national policies with explicit regional dimension | Ministry of Science, Technology and Innovation Programme for Innovative Networks (organisation framework for public-private partnerships in key thematic areas) |
| Example of co-ordination tools | Partnership agreements as well as project co-financing, contracts and on-going dialogue |

Note: The sub-national share of government expenditure (all functions) includes a large share of social security expenses that in other countries are classified separately from national and sub-national expenditure.

Table 7.11. **Instruments by level of government**

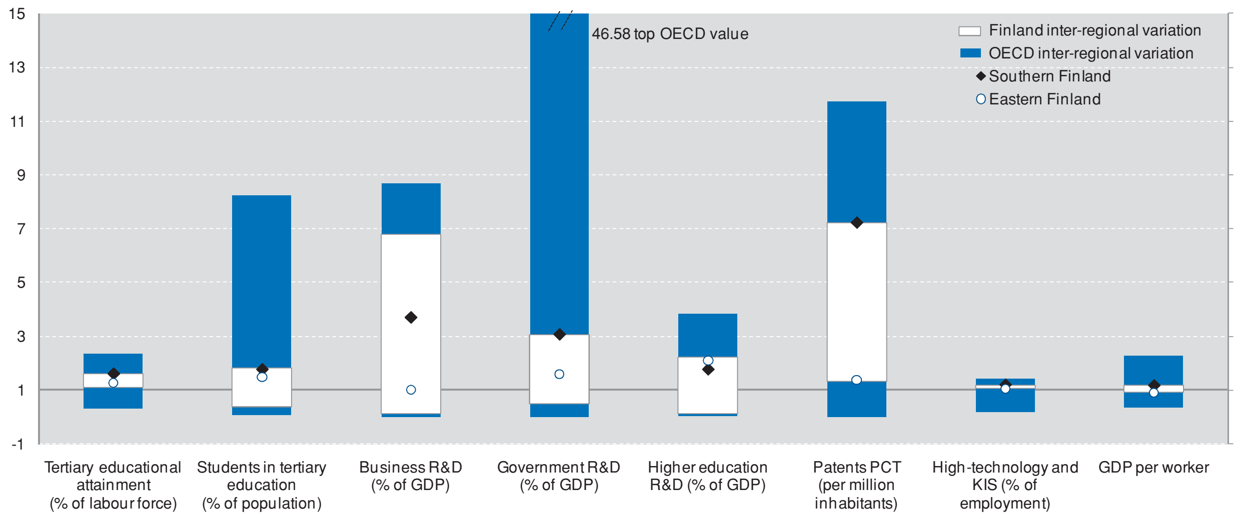
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | |
| Technology foresight exercises (assessing future needs) | X | |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | |
| Seed funding/projects to start PRCs or HEIs | X | |
| Competitive R&D funding by PRCs or HEIs | X | |
| Public subsidies for private R&D | | |
| Tax credits for private R&D | | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | |
| Other technology transfer centres and extension programmes | X | S |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | S |
| Science and technology parks | X | |
| Incubators for new firms | X | S |
| **Financing for innovative firms** | | |
| Public development banks | | |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | |
| Foreign firms eligible for public innovation-related funds | | |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | X |
| Innovation awards | X | |

Notes: PRC=public research centre; HEI=higher education institution.

# Finland

Figure 7.11. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.12. **Categorisation of OECD regions in country**

**Knowledge and technology hubs:**

Southern Finland, Western Finland, Northern Finland

**Service and natural resource regions in knowledge-intensive countries:**

Eastern Finland

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.12. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 5 *Suuralueet/Storomräden* |
| Country structure | Unitary, regions not elected |
| Sub-national share of government expenditure, all functions (2009) | 40.1% |
| Definition of regional role in STI | None for regions as entities, but ELY centres (Centres for Economic Development, Transport and the Environment) created by 2009 law |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | Co-ordination bodies at level of national regional development agencies (ELY centres) or programmes (Centres of Expertise) |
| Regional consideration in national S&T/Innovation Plan | National Innovation Strategy discusses innovation hubs (albeit not the regional dimension of innovation activity) |
| Example of national policies with explicit regional dimension | OSKE – Centres of Expertise Programme |
| Example of co-ordination tools | ELY centres (six national ministries) created to address challenges in synchronising national and regional T&I policies (akin to regional development agency) |

Note: The municipal level is more active than the regional level in a number of instruments in Finland, notably those associated with technology transfer and innovation services to firms as well as innovation collaboration. Some instruments may therefore not be noted in the table because they are supported by the municipal level.

Table 7.13. **Instruments by level of government**

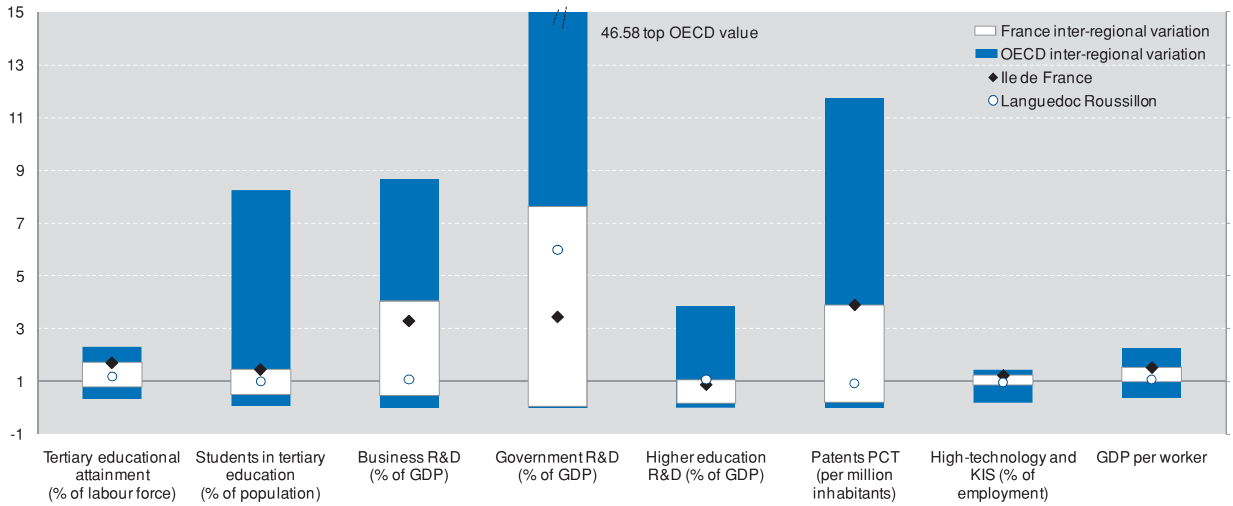
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | | |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | |
| Seed funding/projects to start PRCs or HEIs | | X |
| Competitive R&D funding by PRCs or HEIs | X | |
| Public subsidies for private R&D | X | X |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | | X |
| Advisory to spin-off and knowledge-intensive start-up firms | | X |
| Other technology transfer centres and extension programmes | | |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | | |
| Science and technology parks | | |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | | |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | X | X |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | X | X |
| International trips to develop innovation networks | | |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | X |
| Innovation awards | | |

Notes: PRC=public research centre; HEI=higher education institution.

# France

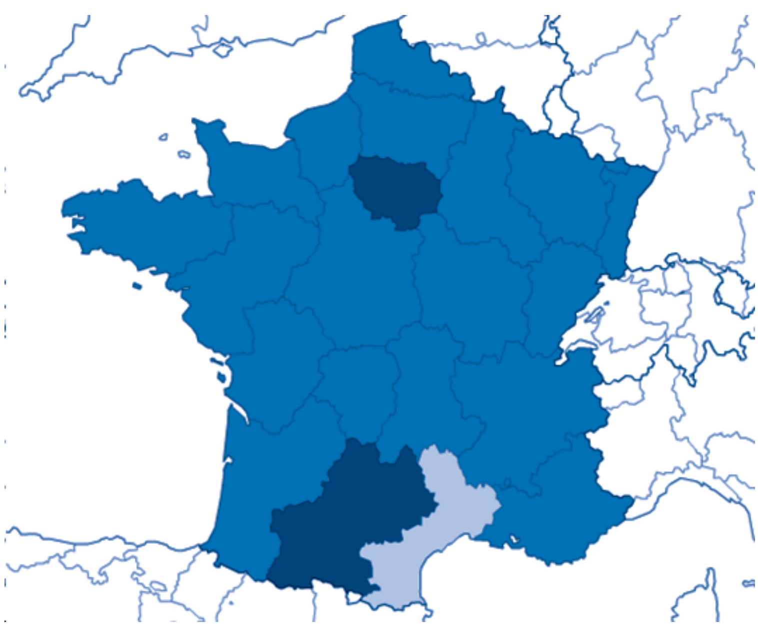
Figure 7.13. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.14. **Categorisation of OECD regions in country**



**Knowledge and technology hubs:**

Ile-de-France, Midi-Pyrénées

**Medium-tech manufacturing and service providers:**

Upper Normandy, Centre, Alsace, Franche-Comté, Provence-Alpes-Côte d'Azur, Brittany, Rhône-Alpes, Auvergne, Champagne-Ardenne, Picardy, Lower Normandy, Burgundy, Pays de la Loire, Poitou-Charentes, Aquitaine, Limousin, Lorraine, Nord-Pas-de-Calais

**Structural inertia or de-industrialising regions:**

Languedoc-Roussillon

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.14. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 25 *régions* |
| Country structure | Unitary, elected regions |
| Sub-national share of government expenditure, all functions (2009) | 20.7% |
| Definition of regional role in STI | General laws on relations between State and sub-national entities |
| Regional role in higher education | National responsibility, ongoing reforms for university autonomy which may call for a greater role of regions |
| Formal national-regional co-ordination bodies | No formal co-ordination body on STI per se, but territorial representatives of two national government ministries, the Regional Delegate for Research and Technology (DRRT – *Délégué régional à la recherche et à la technologie)* and the Regional Office for Industry, Research and the Environment (*DRIRE – Direction régionale de l'industrie, de la recherche et de l'environnement*) |
| Regional consideration in national S&T/Innovation Plan | National Strategy for Research and Innovation recognises importance of regional ecosystems of innovation |
| Example of national policies with explicit regional dimension | *Pôles de compétitivé* programme (industrial and research support) that supports research-intensive hubs throughout the country; other programmes to support research centres and networks |
| Example of co-ordination tools | Use of contracting with regions that includes innovation-related projects (*Contrat de projet État-région*) in addition to national territorial representatives and other project co-financing |

Notes: While regions have implemented a range of instruments, the national government remains the principal financer or co-financer. Some cities and departments are also active in a range of innovation instruments, including those to promote technology transfer, innovation services and innovation collaboration, including incubators for new firms.

Table 7.15. **Instruments by level of government**

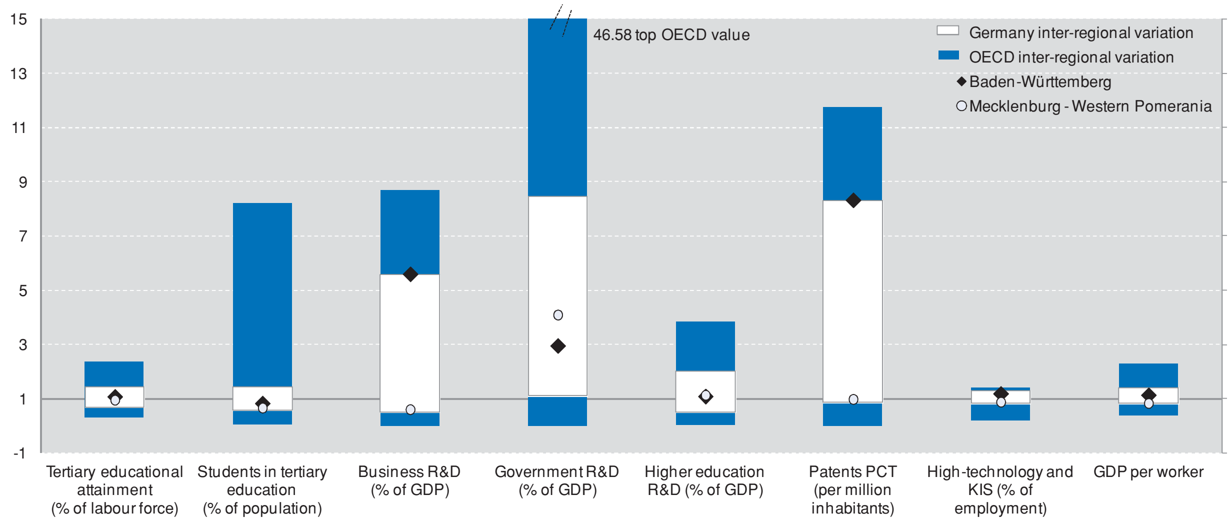
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | S |
| Targeted human resource training (directly, subsidies) | X | S |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | |
| Seed funding/projects to start PRCs or HEIs | X | |
| Competitive R&D funding by PRCs or HEIs | X | X |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | S |
| Multi-disciplinary technology platforms | X | S |
| Science and technology parks | | S |
| Incubators for new firms | | |
| **Financing for innovative firms** | | |
| Public development banks | X | |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | S |
| Foreign firms eligible for public innovation-related funds | X | X |
| International trips to develop innovation networks | X | S |
| **Other programmes** | | |
| Public procurement policy with innovation focus | | |
| Innovation awards | X | S |

Notes: PRC=public research centre; HEI=higher education institution.

## Germany

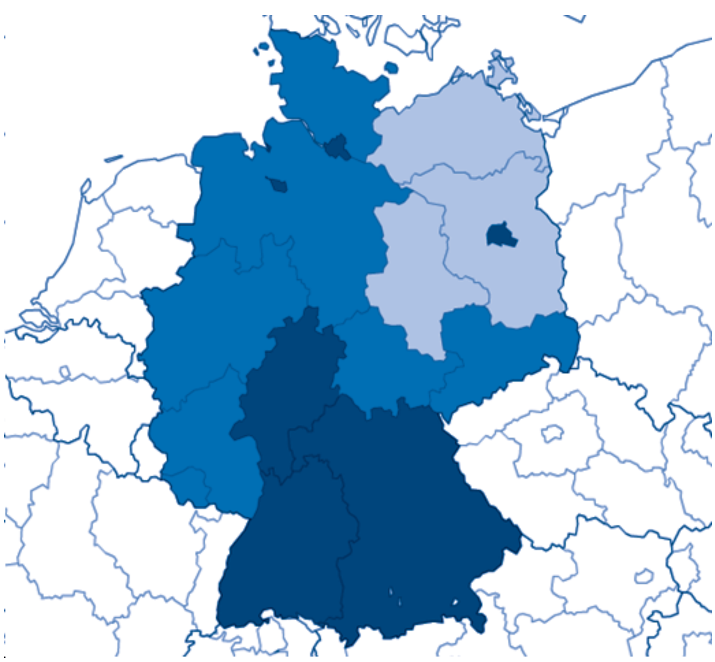
Figure 7.15. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.16. **Categorisation of OECD regions in country**



**Knowledge-intensive city/capital districts:**

Berlin, Bremen, Hamburg

**Knowledge and technology hubs:**

Baden-Württemberg, Bavaria, Hesse

**Medium-tech manufacturing and service providers:**

Lower Saxony, North Rhine-Westphalia, Saarland, Schleswig-Holstein, Rhineland-Palatinate, Saxony, Thuringia

**Structural inertia or de-industrialising regions:**

Brandenburg, Mecklenburg-Western Pomerania, Saxony-Anhalt

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.16. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 16 *Länder* |
| Country structure | Federal |
| Sub-national share of government expenditure, all functions (2009) | 37% (21.2% *Länder* and 15.7% local) |
| Definition of regional role in STI | Constitution states that some STI tasks for the national government (thematic R&D funding, institutional funding of large public research organisations, horizontal and international dimensions, innovation-oriented programmes), others for the *Länder,* and some that are a "joint task" between the two (such as funding of non-university research institutes) |
| Regional role in higher education | *Länder* responsible for financing research and teaching at public universities |
| Formal national-regional co-ordination bodies | The Joint Conference of Science (GWK) created in 2008 (and superseding a prior entity) meets three times a year with federal government as well as all *Länder* representatives as equal partners. It informs on areas of exclusive competence and decides on joint financing projects. There are also new joint commissions such as the Council for Innovation and Growth and the Research Union Science-Industry. |
| Regional consideration in national S&T/Innovation Plan | The regional dimension is the third pillar of the National Policy for Innovation |
| Example of national policies with explicit regional dimension | Innoregio and NEMO supported networks in the Eastern *Länder*, the Competence Centres Programme gives labels to "clusters" around the country, etc. |
| Example of co-ordination tools | Formal bodies support consultation and on-going dialogue in STI across levels, in addition to contracts and project co-financing |

Notes: The sub-*Länder* level is also active in a number of these instruments. The governance picture is complex given the number of other governmental forms, including city-regions, and various governance levels between "*Land*" and "*Stadt/Gemeinde*" or municipality.

Table 7.17. **Instruments by level of government**

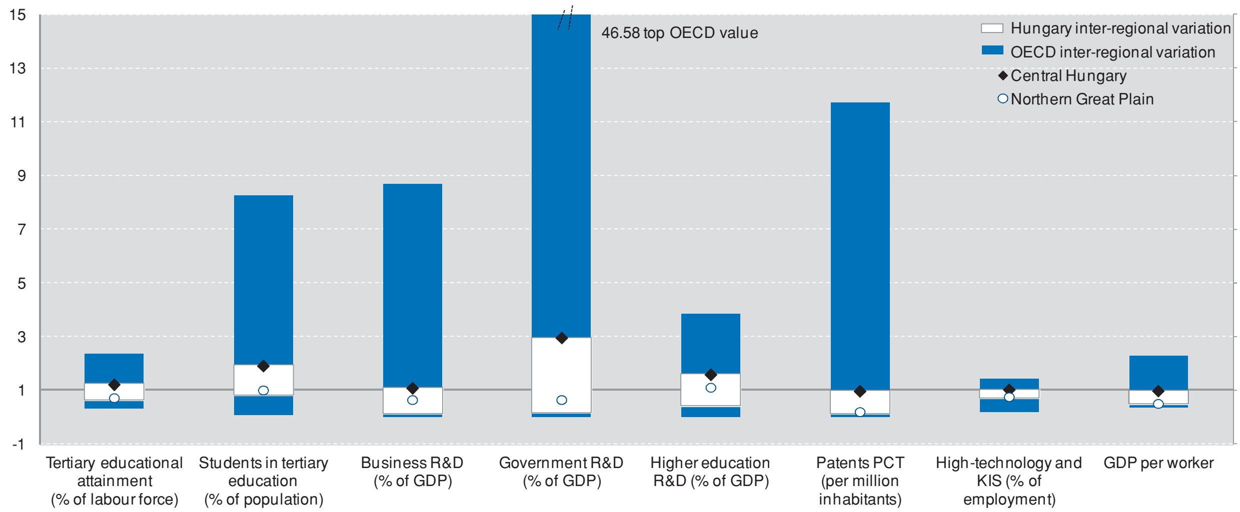
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | X |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | S |
| Technology foresight exercises (assessing future needs) | X | S |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | X | X |
| Competitive R&D funding by PRCs or HEIs | X | X |
| Public subsidies for private R&D | X | X |
| Tax credits for private R&D | | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | X |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | S |
| Science and technology parks | | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | S |
| Public venture capital funds or stakes in private funds | X | X |
| Guarantees | X | S |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | | X |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | X |
| Innovation awards | X | X |

Notes: PRC=public research centre; HEI=higher education institution.

## Hungary

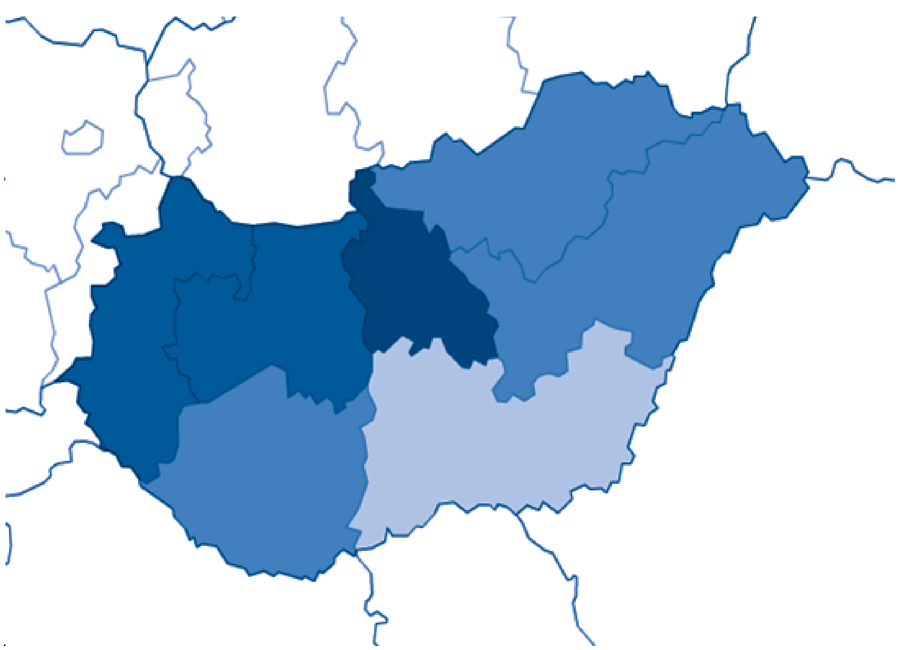
Figure 7.17. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.18. **Categorisation of OECD regions in country**



**Medium-tech manufacturing and service providers:**
Central Hungary

**Traditional manufacturing regions:**
Central Transdanubia, Western Transdanubia

**Structural inertia or de-industrialising regions:**
Southern Transdanubia, Northern Hungary, Northern Great Plain

**Primary-sector-intensive regions:**
Southern Great Plain

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.18. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 7 planning statistical regions |
| Country structure | Unitary, regions not elected |
| Sub-national share of government expenditure, all functions (2008) | 23.2% |
| Definition of regional role in STI | Act XC/2003 on the Research and Technology Innovation Fund<br>Decree 270/2007 (XII. 24.) on the Research and Technology Innovation Council<br>Act XXI/1996 on Regional Development |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | No formal bodies on STI, but the Ministry for National Development and Economy (through the National Office for Research and Technology and the National Development Agency) has regional innovation agencies and regional development agencies |
| Regional consideration in national S&T/Innovation Plan | The government's mid-term (2007-2013) science, technology and innovation policy (STI) strategy goals include: *i)* enhancing regions' RDI capacity; and *ii)* investing in large scientific facilities, primarily in regional centres and development poles, reducing regional differences (regional cohesion). |
| Example of national policies with explicit regional dimension | Hungarian Pole (cluster) Programme modelled after France; Baross Gábor Programme for R&D&I projects of SMEs/ R&D organisations and R&D infrastructure, regional innovation agencies network provides innovation/networking services; EU Structural Funds support clusters, regional innovation, incubators, etc. |
| Example of co-ordination tools | Contracts are used with the aforementioned regional innovation agencies, no other tools are commonly used |

Note: Important role of EU Structural Funds for supporting regional innovation strategies and programmes.

Table 7.19. **Instruments by level of government**

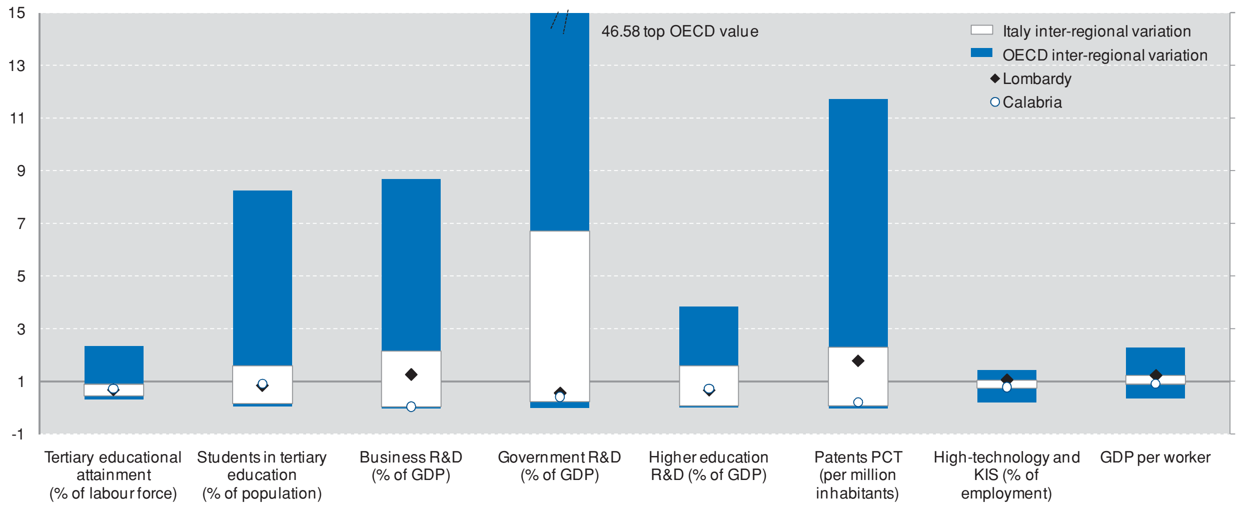
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | |
| Technology foresight exercises (assessing future needs) | X | |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | |
| Seed funding/projects to start PRCs or HEIs | X | |
| Competitive R&D funding by PRCs or HEIs | X | |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | |
| Advisory to spin-off and knowledge-intensive start-up firms | X | |
| Other technology transfer centres and extension programmes | X | |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | |
| Multi-disciplinary technology platforms | X | |
| Science and technology parks | X | |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | | |
| Public venture capital funds or stakes in private funds | X | |
| Guarantees | X | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | |
| Foreign firms eligible for public innovation-related funds | X | |
| International trips to develop innovation networks | X | |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | |
| Innovation awards | | |

Notes: PRC=public research centre; HEI=higher education institution.

## Italy

Figure 7.19. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.20. **Categorisation of OECD regions in country**

**Medium-tech manufacturing and service providers:**

Liguria, Lazio

**Traditional manufacturing regions:**

Piedmont, Lombardy, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Tuscany, Marche, Province of Trento, Umbria, Province of Bolzano-Bozen

**Structural inertia or de-industrialising regions:**

Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria, Sicily, Sardinia

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.20. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 20 regions and 2 autonomous provinces |
| Country structure | Unitary, elected regions |
| Sub-national share of government expenditure, all functions (2009) | 31.1% |
| Definition of regional role in STI | Constitutional Law No. 3 of 2001 expanded the powers and autonomy of the regions enabling a stronger role for regions in innovation policy |
| Regional role in higher education | Co-financing |
| Formal national-regional co-ordination bodies | *Conferenza Stato-Regioni* for co-ordination in S&T policies |
| Regional consideration in national S&T/Innovation Plan | Not a major consideration |
| Example of national policies with explicit regional dimension | Technological districts, industrial districts, EU Structural Funds |
| Example of co-ordination tools | Contracts and project co-financing |

Table 7.21. **Instruments by level of government**

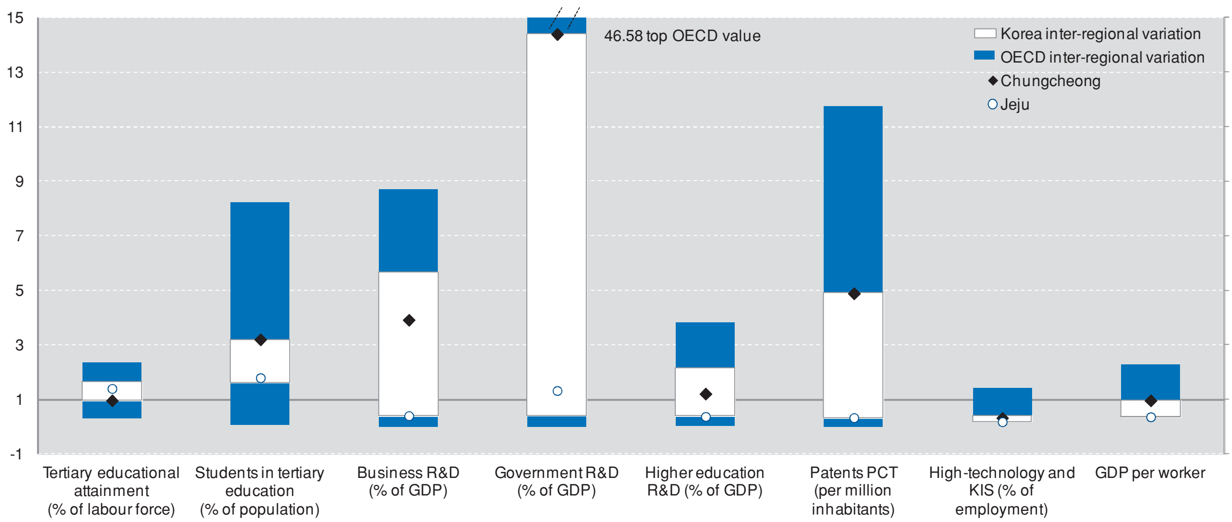
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | S |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | | S |
| Technology foresight exercises (assessing future needs) | | S |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | S |
| Seed funding/projects to start PRCs or HEIs | X | S |
| Competitive R&D funding by PRCs or HEIs | X | S |
| Public subsidies for private R&D | X | X |
| Tax credits for private R&D[1] | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | | S |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | S |
| Other technology transfer centres and extension programmes | X | S |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | S |
| Multi-disciplinary technology platforms | X | S |
| Science and technology parks | | X |
| Incubators for new firms | | X |
| **Financing for innovative firms** | | |
| Public development banks | X | S |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | X | X |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | S |
| Foreign firms eligible for public innovation-related funds | X | S |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | | S |
| Innovation awards | X | S |

Notes: PRC=public research centre; HEI=higher education institution.

# Korea

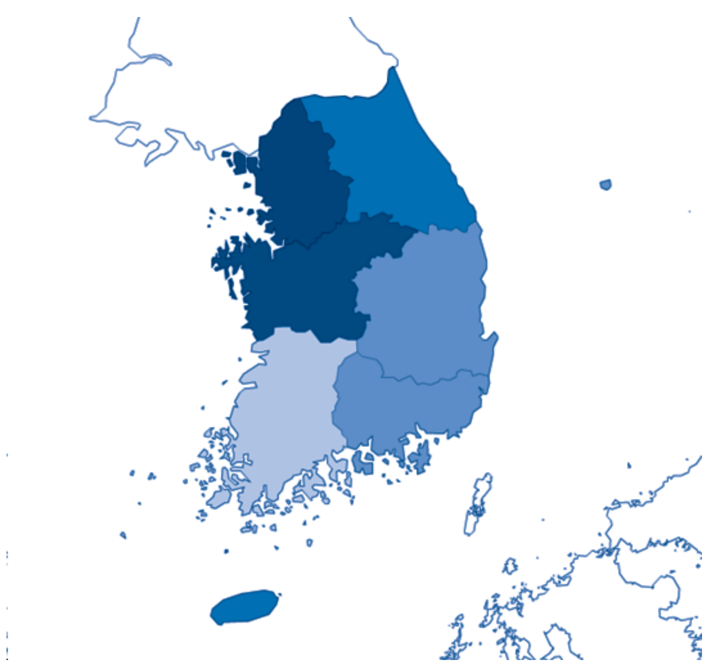
Figure 7.21. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.22. **Categorisation of OECD regions in country**



**Knowledge-intensive city/capital districts:**

Capital Region

**Knowledge and technology hubs:**

Chungcheong

**Service and natural resource regions in knowledge-intensive countries:**

Gangwon , Jeju

**Medium-tech manufacturing and service providers:**

Gyeongnam, Gyeonbuk

**Traditional manufacturing regions:**

Jeolla

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.22. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 7 regions |
| Country structure | Unitary, regions not elected |
| Sub-national share of government expenditure, all functions (2007) | 44.5% |
| Definition of regional role in STI | S&T Law |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | National S&T Council meets biannually and includes several ministries, Presidential Committee on Regional Development, and the regional governments |
| Regional consideration in national S&T/Innovation Plan | National five-year S&T Plan and the Development Plan for Regional Science Parks both seek to develop core R&D fields in each region as well as to promote interaction among regional innovation system actors |
| Example of national policies with explicit regional dimension | Programmes from the Ministry of Education, S&T as well as Ministry of Knowledge Economy promote programmes for regional university capacity, science parks, strategy industry development and regional industrial clusters |
| Example of co-ordination tools | National territorial representatives (including those from the Ministry of Education, Science and Technology and the Ministry of Knowledge Economy) but also consultation processes, ongoing dialogue, agencies, contracts (typically for science parks and technology parks) and project co-financing |

Note: While there are many instruments reported at regional level in some regions, they tend to rely on significant financing and management by the central government.

Table 7.23. **Instruments by level of government**

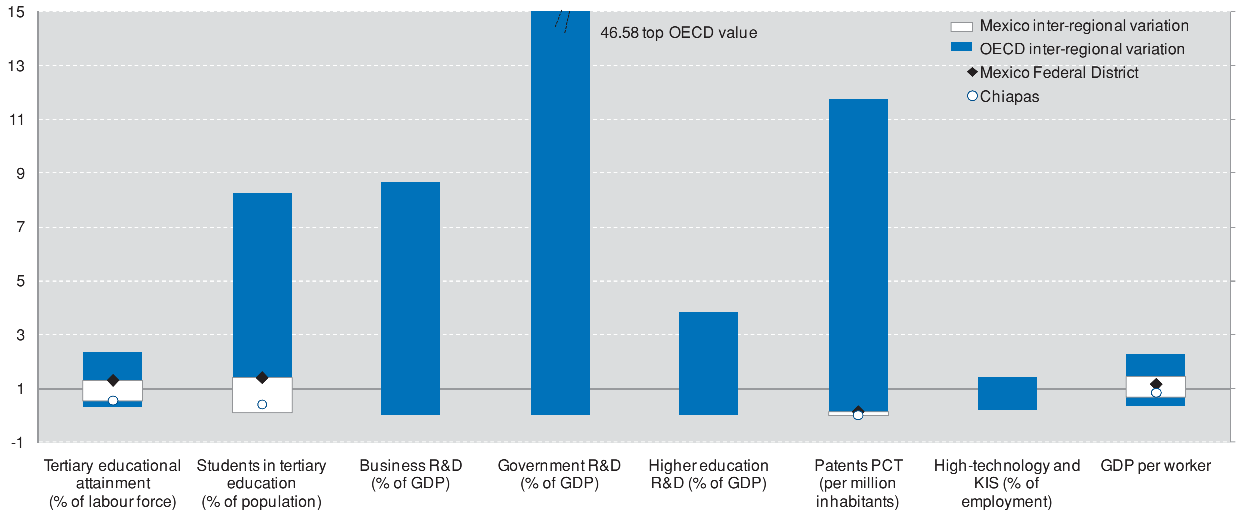
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | S |
| Targeted human resource training (directly, subsidies) | X | S |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | S |
| Technology foresight exercises (assessing future needs) | X | S |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | S |
| Seed funding/projects to start PRCs or HEIs | X | S |
| Competitive R&D funding by PRCs or HEIs | X | S |
| Public subsidies for private R&D | X | S |
| Tax credits for private R&D | X | S |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | S |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | S |
| Advisory to spin-off and knowledge-intensive start-up firms | X | S |
| Other technology transfer centres and extension programmes | X | S |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | S |
| Branded excellence poles or hubs (label and multiple actors) | X | S |
| Multi-disciplinary technology platforms | X | S |
| Science and technology parks | X | S |
| Incubators for new firms | X | S |
| **Financing for innovative firms** | | |
| Public development banks | X | S |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | X | S |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | S |
| Foreign firms eligible for public innovation-related funds | X | S |
| International trips to develop innovation networks | X | S |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | S |
| Innovation awards | X | S |

Notes: PRC=public research centre; HEI=higher education institution.

# Mexico

Figure 7.23. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.24. **Categorisation of OECD regions in country**


Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.24. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 32 (31 states + 1 Federal District) |
| Country structure | Federal |
| Sub-national share of government expenditure, all functions (2002) | 38.3% |
| Definition of regional role in STI | Constitution exists, but S&T Law provides greater clarity on this policy field |
| Regional role in higher education | Public universities belonging to states managed and funded by states, a few federal universities funded directly by national government |
| Formal national-regional co-ordination bodies | National Conference for S&T meets two or three times per year (State Councils of S&T and National Council of Science and Technology) |
| Regional consideration in national S&T/Innovation Plan | *Programa Especial de Ciencia y Tecnología 2008-2012* raises the need to strengthen state STI systems and to support STI infrastructure (physical and human capital) |
| Example of national policies with explicit regional dimension | FOMIX Programme provides co-funding for states to support scientific and technological development. FORDECYT provides funding for thematic or geographic projects involving actors in multiple states |
| Example of co-ordination tools | In addition to the consultation and dialogue via formal co-ordination bodies, contracts and project co-financing are other tools used actively |

Note: While Mexico is a federation, fiscal arrangements across levels of government limit somewhat a state's ability to finance STI programmes.

Table 7.25. **Instruments by level of government**

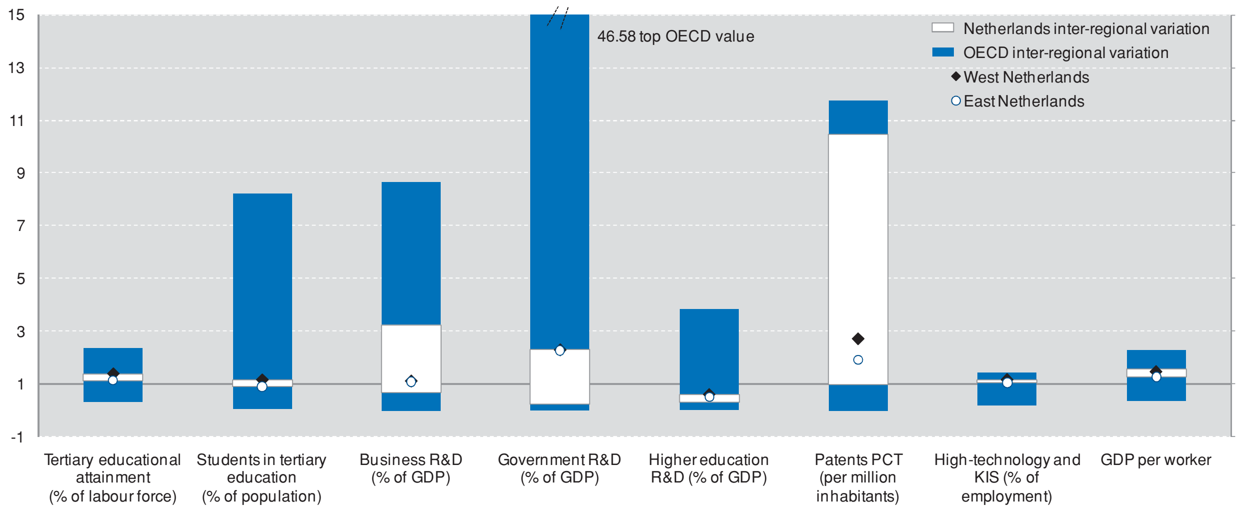
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | S |
| Targeted human resource training (directly, subsidies) | X | S |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | S |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | X | X |
| Competitive R&D funding by PRCs or HEIs | X | S |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | |
| Advisory to spin-off and knowledge-intensive start-up firms | X | |
| Other technology transfer centres and extension programmes | X | |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | S |
| Branded excellence poles or hubs (label and multiple actors) | X | S |
| Multi-disciplinary technology platforms | X | |
| Science and technology parks | X | S |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | |
| Public venture capital funds or stakes in private funds | X | |
| Guarantees | X | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | |
| Foreign firms eligible for public innovation-related funds | | |
| International trips to develop innovation networks | | S |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | |
| Innovation awards | X | S |

Notes: PRC=public research centre; HEI=higher education institution.

# Netherlands

Figure 7.25. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.26. **Categorisation of OECD regions in country**

**Knowledge and technology hubs:**

Southern Netherlands

**Service and natural resource regions in knowledge-intensive countries:**

Northern Netherlands, Eastern Netherlands, Western Netherlands

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.26. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 12 provinces (grouped into 4 *Landsdelen*) |
| Country structure | Unitary, elected regions (provinces) |
| Sub-national share of government expenditure, all functions (2009) | 34.4% |
| Definition of regional role in STI | No formal definition (roles defined on a programme basis) |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | There are no specific STI co-ordination bodies |
| Regional consideration in national S&T/Innovation Plan | Innovation Platforms include recognition of some place-based instruments; also Peaks in the Delta (see below) |
| Example of national policies with explicit regional dimension | Peaks in the Delta (2006 and upcoming renewal) considers regional areas of expertise and strength (clusters, science parks, etc.) |
| Example of co-ordination tools | Project co-financing and contracts are used, as well as joint participation in some provincial economic development agencies |

Table 7.27. **Instruments by level of government**

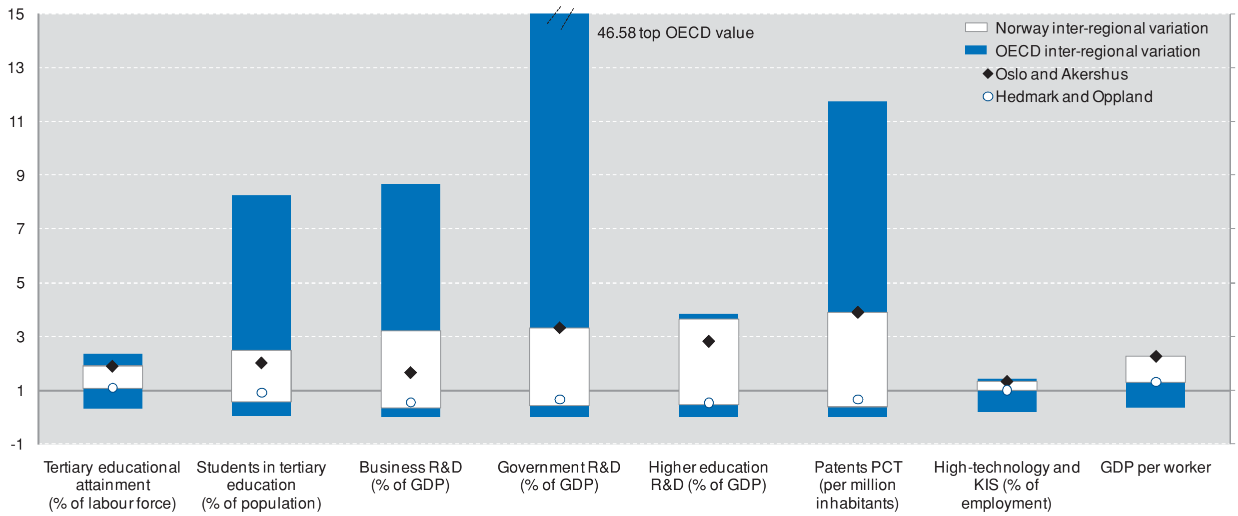
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | |
| Seed funding/projects to start PRCs or HEIs | | |
| Competitive R&D funding by PRCs or HEIs | X | S |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | S |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | S |
| Other technology transfer centres and extension programmes | X | |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | S |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | | |
| Science and technology parks | X | X |
| Incubators for new firms | X | S |
| **Financing for innovative firms** | | |
| Public development banks | X | X |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | X | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | X | |
| International trips to develop innovation networks | | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | |
| Innovation awards | X | |

Notes: PRC=public research centre; HEI=higher education institution.

# Norway

Figure 7.27. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.28. **Categorisation of OECD regions in country**

**Service and natural resource regions in knowledge-intensive countries:**

Oslo and Akershus, Sør-Østlandet, Agder and Rogaland, Western Norway, Trøndelag, Hedmark and Oppland, Northern Norway

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.28. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 7 *Landsdeler* group 19 *Fylker* (counties) |
| Country structure | Unitary, regions (counties) not elected |
| Sub-national share of government expenditure, all functions (2009) | 32.6% |
| Definition of regional role in STI | Role of counties generally defined in Norwegian State Budget Rules and the 2002 Devolution Budget Reform |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | The 12 regional representatives of the Research Council of Norway (under the Ministry of Trade and Industry) work to stimulate research at the regional level. Since 2010, Innovation Norway plays this role as well |
| Regional consideration in national S&T/Innovation Plan | White Papers on Innovation (2008) and administrative reform (December 2007) discuss a need for regionally differentiated innovation policy |
| Example of national policies with explicit regional dimension | VRI Programme sponsored by multiple ministries is the Research Council's main support mechanism for research and innovation in all regions. The NCE (National Centres of Expertise) is a long-term cluster programme for industrial regions |
| Example of co-ordination tools | The regional representatives of the Research Council of Norway and joint ownership of Innovation Norway are complemented by ongoing dialogue and project co-financing |

Notes: Since 2010, Innovation Norway is jointly owned by the regions (49%) and the national government (51%). Therefore, the regional responsibility for design and funding of Innovation Norway's programme portfolio (covering substantial parts of Norway's innovation policy) has increased.

In 2010, seven new regional funds were capitalised by the national government and the county-municipalities are responsible for the administration and direction of these funds.

Table 7.29. **Instruments by level of government**

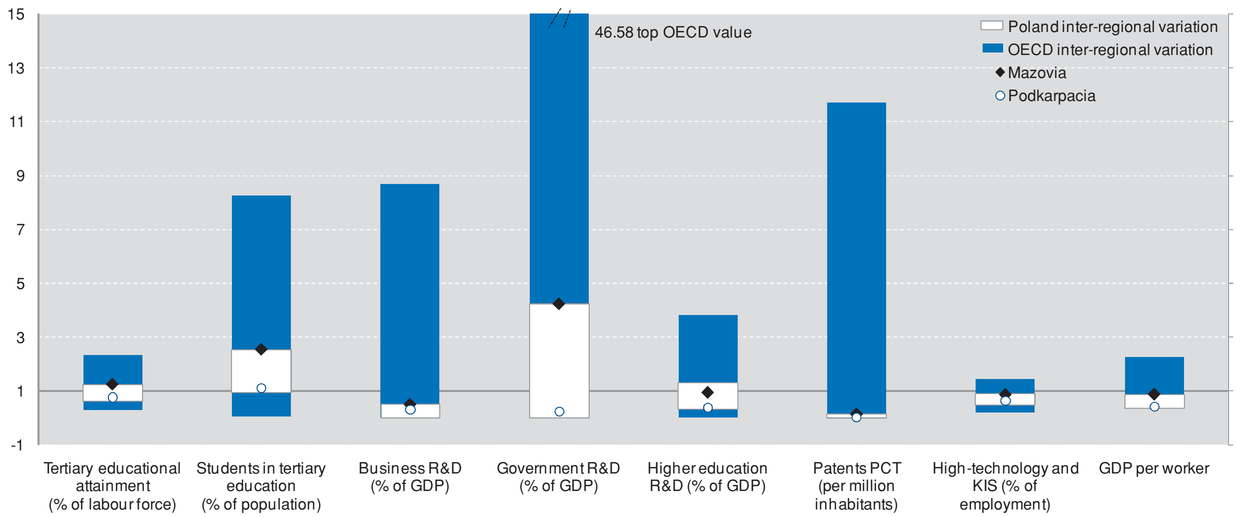
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | X |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | | |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | X | |
| Competitive R&D funding by PRCs or HEIs | X | X |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | S |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | X |
| Science and technology parks | X | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | |
| Public venture capital funds or stakes in private funds | X | X |
| Guarantees | X | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | | |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | X |
| Innovation awards | X | X |

Notes: PRC=public research centre; HEI=higher education institution.

# Poland

Figure 7.29. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.30. **Categorisation of OECD regions in country**

**Structural inertia or de-industrialising regions:**

Silesia, West Pomerania, Pomerania, Lower Silesia

**Primary-sector-intensive regions:**

Mazovia, Lodzkie, Malopolskie, Lublin, Podkarpacia, Swietokrzyskie, Podlasie, Greater Poland, Lubusz, Opole, Kuyavian-Pomerania, Warmian-Masuria

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.30. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 16 *Województwa* (*voivodeship*) |
| Country structure | Unitary, elected regions |
| Sub-national share of government expenditure, all functions (2009) | 33.3% |
| Definition of regional role in STI | Roles defined in various laws on regions and economic development as well as strategies |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | No formal co-ordination bodies yet (see Note 2), but co-ordination around regional programmes for EU Structural Funds with national and regional representatives |
| Regional consideration in national S&T/Innovation Plan | National Strategic Reference Framework 2007-2013 seeks to enhance the competitiveness of science through regional range research centres and considers research programmes based on priorities from the regional innovation strategies. |
| Example of national policies with explicit regional dimension | Regional operational programmes financed by EU Structural Funds including to support human capital and an innovative economy |
| Example of co-ordination tools | Consultation and dialogue are the main tools used, with some project co-financing and agreements |

Notes: EU Structural Funds play a notable role in the financing of many innovation-related instruments. Nevertheless, regions are the principal managers of many programmes, notably for innovation collaboration and international collaboration.

Poland is working to establish a Council for Science and Innovation which would have as one its main tasks to establish co-ordination between regional and national bodies.

Table 7.31. **Instruments by level of government**

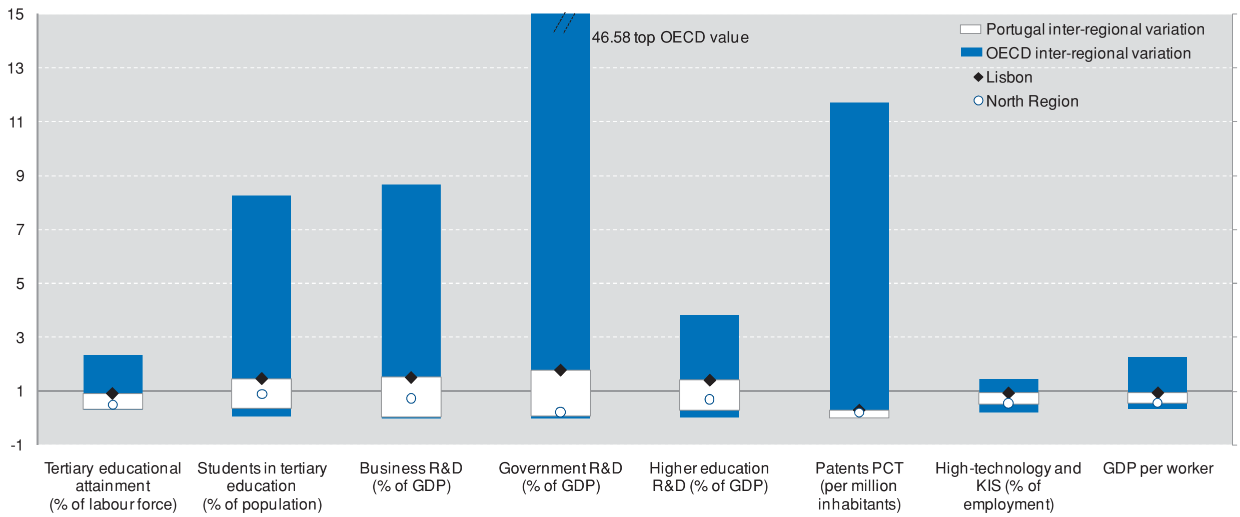
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | X |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | S |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | S |
| Seed funding/projects to start PRCs or HEIs | X | X |
| Competitive R&D funding by PRCs or HEIs | X | X |
| Public subsidies for private R&D | X | X |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | X |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | X |
| Science and technology parks | X | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | |
| Public venture capital funds or stakes in private funds | X | X |
| Guarantees | X | X |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | X | X |
| International trips to develop innovation networks | | S |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | X |
| Innovation awards | X | S |

Notes: PRC=public research centre; HEI=higher education institution.

# Portugal

Figure 7.31. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.32. **Categorisation of OECD regions in country**

**Medium tech manufacturing and service providers:**

Lisbon

**Primary-sector-intensive regions:**

Northern Region, Central Region, Alentejo

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.32. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 7 *Comissaoes de coordenaçao regional* (regional co-ordination commissions) and 2 autonomous regions |
| Country structure | Unitary country, regions not elected |
| Sub-national share of government expenditure, all functions (2009) | 13.1% |
| Definition of regional role in STI | Not defined |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | No formal bodies for STI |
| Regional consideration in national S&T/Innovation Plan | Technological Plan (2005) promotes regional and bottom-up poles and clusters as well as takes into account regional innovation plans |
| Example of national policies with explicit regional dimension | Cluster programmes with inter-ministerial support, including separate version for low-density areas |
| Example of co-ordination tools | Few co-ordination tools for STI, mainly dialogue and consultation |

Note: Important role of EU Structural Funds for supporting regional innovation strategies and programmes.

Table 7.33. **Instruments by level of government**

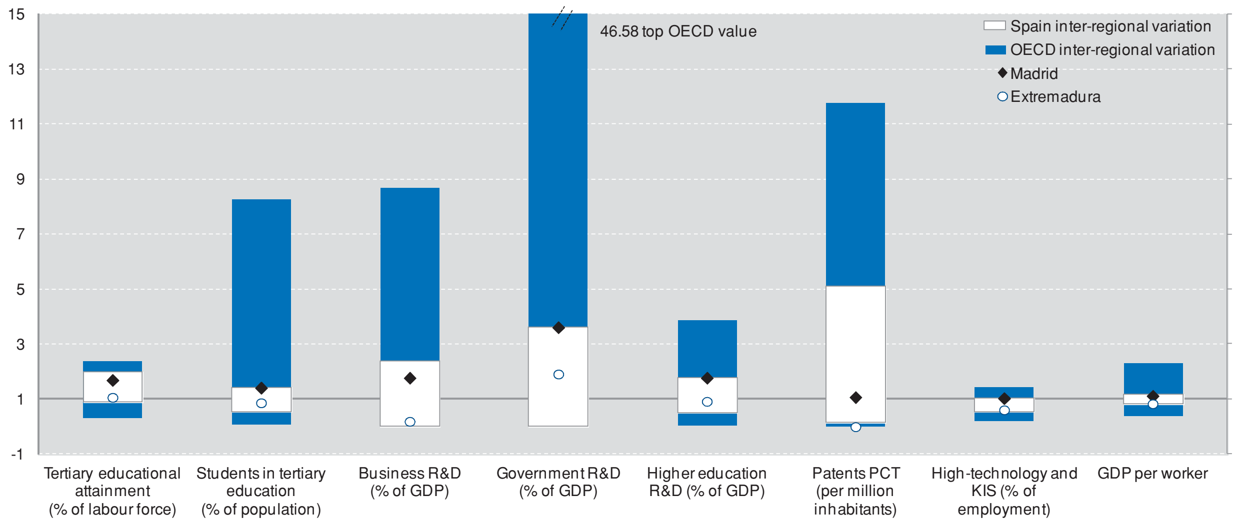
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | |
| Technology foresight exercises (assessing future needs) | | |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | S |
| Seed funding/projects to start PRCs or HEIs | X | S |
| Competitive R&D funding by PRCs or HEIs | X | |
| Public subsidies for private R&D | X | X |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | | X |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | S |
| Advisory to spin-off and knowledge-intensive start-up firms | X | S |
| Other technology transfer centres and extension programmes | X | S |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | X |
| Science and technology parks | X | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | |
| Public venture capital funds or stakes in private funds | X | |
| Guarantees | X | X |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | |
| Foreign firms eligible for public innovation-related funds | X | |
| International trips to develop innovation networks | X | |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | |
| Innovation awards | X | |

Notes: PRC=public research centre; HEI=higher education institution.

# Spain

Figure 7.33. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database.*

Figure 7.34. **Categorisation of OECD regions in country**

**Medium-tech manufacturing and service providers:**

Madrid, Catalonia, Basque Country, Navarre

**Structural inertia or de-industrialising regions:**

Aragon, La Rioja, Galicia, Asturias, Cantabria, Castile and León, Balearic Islands, Castile-La Mancha, Extremadura, Valencia, Andalusia, Murcia, Canary Islands

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.34. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 17 autonomous communities |
| Country structure | Unitary, elected regions |
| Sub-national share of government expenditure, all functions (2008) | 36.3% regions + 13.2% localities |
| Definition of regional role in STI | Constitution gives Spanish State competency "co-ordinating and promoting scientific and technical research", the rest is the competency of the regions<br>S&T Law and National Research Plan provide additional clarifications |
| Regional role in higher education | Funding of HEI staff, facilities and programmes, by regions subject to regulations on staffing and accreditation at national level |
| Formal national-regional co-ordination bodies | Scientific and Technology General Council established by 1983 law and in practice serves an information-sharing role. Scientific and Technology National Strategy also involves co-ordination Spain-regions. |
| Regional consideration in national S&T/Innovation Plan | National Research Plan and Science and Technology National Strategy include a National Fund for R&D&I; Strategic Fund for Technological and Research Infrastructure; Territorial Co-operation one of five aspects of the e2i Spanish Innovation Strategy |
| Example of national policies with explicit regional dimension | Specific transfers and funds to regions for this policy (grants and loans) |
| Example of co-ordination tools | Contracts (*convenios*) between Spain and regions for S&T infrastructure, co-operation at policy level |

Note: For the foral regimes in Spain where tax collection is done at sub-national level (three provinces of Basque Country and Navarra), tax credits are managed by the sub-national entity.

Table 7.35. **Instruments by level of government**

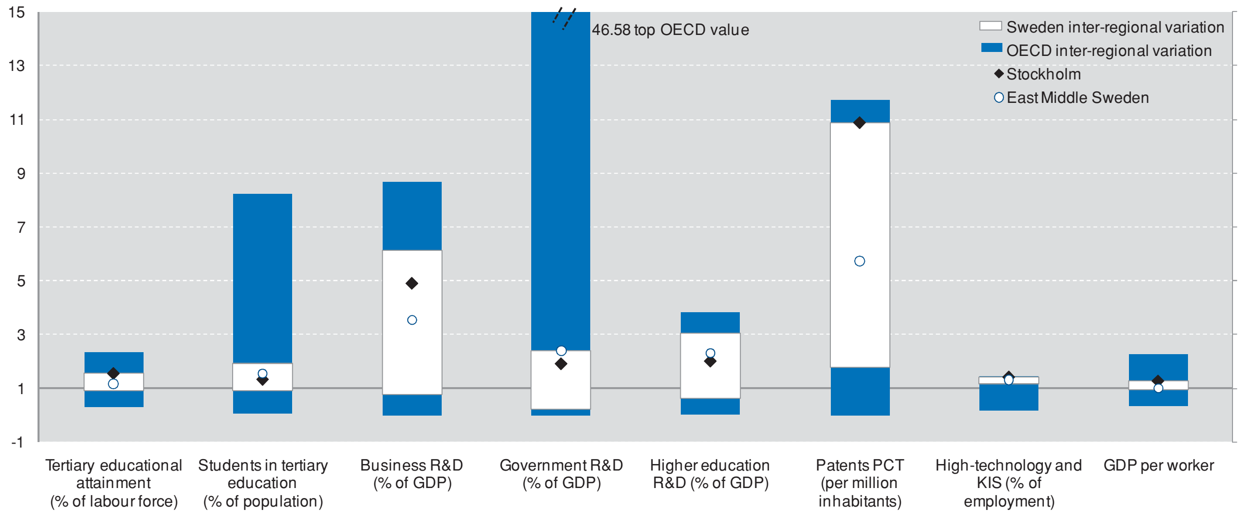
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | X |
| Targeted human resource training (directly, subsidies) | X | |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | |
| Technology foresight exercises (assessing future needs) | | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | | X |
| Competitive R&D funding by PRCs or HEIs | X | X |
| Public subsidies for private R&D | X | X |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | | X |
| Branded excellence poles or hubs (label and multiple actors) | | X |
| Multi-disciplinary technology platforms | X | X |
| Science and technology parks | X | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | S |
| Public venture capital funds or stakes in private funds | | S |
| Guarantees | X | S |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | |
| Foreign firms eligible for public innovation-related funds | | |
| International trips to develop innovation networks | | S |
| **Other programmes** | | |
| Public procurement policy with innovation focus | | |
| Innovation awards | X | X |

Notes: PRC=public research centre; HEI=higher education institution.

## Sweden

Figure 7.35. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.36. **Categorisation of OECD regions in country**

**Knowledge and technology hubs:**

Stockholm, South Sweden, West Sweden, East Middle Sweden

**Service and natural resource regions in knowledge-intensive countries:**

Småland and the Islands, North Middle Sweden, Middle Norrland, Upper Norrland

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.36. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 8 *Riksområden* regroup the 21 *Län* (counties) |
| Country structure | Unitary, elected regions (counties) |
| Sub-national share of government expenditure, all functions (2009) | 46.9% |
| Definition of regional role in STI | Regulations for programmes |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | Regional agencies that report to the Ministry of Enterprise, Energy and Communication (MEEC) cover innovation and regional growth policy |
| Regional consideration in national S&T/Innovation Plan | National strategy for regional competitiveness, entrepreneurship and employment |
| Example of national policies with explicit regional dimension | Vinnväxt (competitive programme to support triple helix and technology-intensive clusters), VINN Excellence Centres (competitive programme for universities), and general cluster development programme |
| Example of co-ordination tools | The regional agencies and ongoing dialogue are the main co-ordination tools for innovation, with contracts and co-financing for specific centres and projects |

Note: Sub-national spending includes amounts that in other countries may be considered separately for social security expenses.

Table 7.37. **Instruments by level of government**

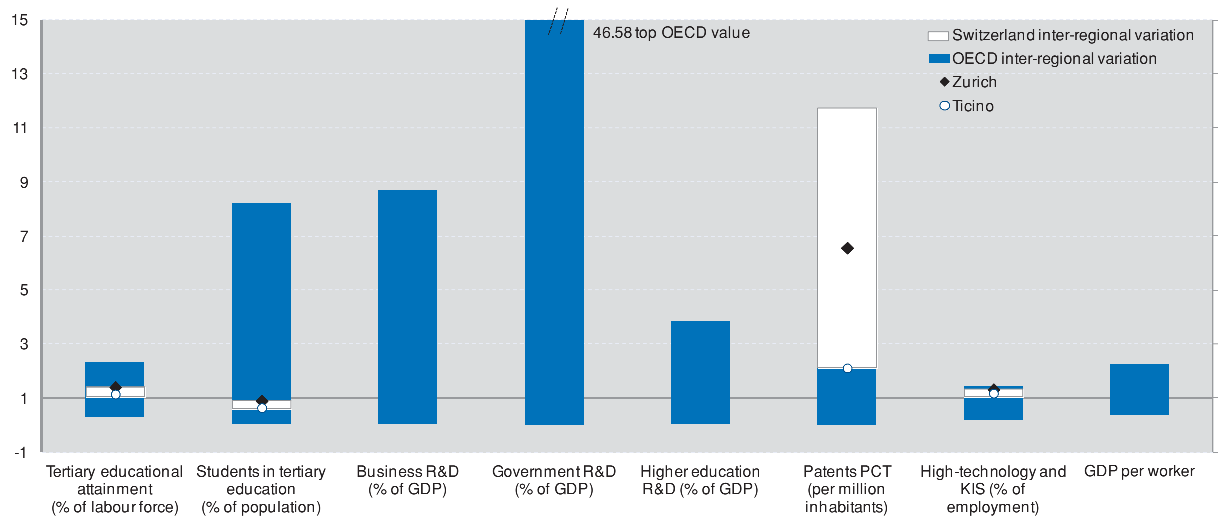
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | | |
| Targeted human resource training (directly, subsidies) | | |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | S |
| Technology foresight exercises (assessing future needs) | | S |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | |
| Seed funding/projects to start PRCs or HEIs | | |
| Competitive R&D funding by PRCs or HEIs | | |
| Public subsidies for private R&D | X | X |
| Tax credits for private R&D | | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | S |
| Advisory to spin-off and knowledge-intensive start-up firms | X | S |
| Other technology transfer centres and extension programmes | X | |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | |
| Multi-disciplinary technology platforms | | |
| Science and technology parks | | S |
| Incubators for new firms | | S |
| **Financing for innovative firms** | | |
| Public development banks | | S |
| Public venture capital funds or stakes in private funds | X | X |
| Guarantees | | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | |
| Foreign firms eligible for public innovation-related funds | X | |
| International trips to develop innovation networks | | |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | |
| Innovation awards | | |

Notes: PRC=public research centre; HEI=higher education institution.

## Switzerland

Figure 7.37. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.38. **Categorisation of OECD regions in country**

Regions could not be categorised due to lack of data on variables at sub-national level.

Note: This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.38. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 7 *grandes régions* group the 26 cantons of the confederation |
| Country structure | Federal |
| Sub-national share of government expenditure, all functions (2009) | 56% (35.3% and 20.7%) |
| Definition of regional role in STI | Constitution and constitutional dispositions |
| Regional role in higher education | Federations and cantons each responsible for their own universities; Universities of Applied Science jointly financed |
| Formal national-regional co-ordination bodies | For higher education, several common bodies between the confederation and cantons |
| Regional consideration in national S&T/Innovation Plan | Research policy federal: no inclusion of regional role |
| Example of national policies with explicit regional dimension | KTT-consortia, sponsored by the Swiss innovation promotion agency, are a vehicle for SMEs to access regionally and thematically grouped areas of university expertise |
| Example of co-ordination tools | In addition to the formal co-ordination bodies that also facilitate on-going dialogue, contracts and agreements are used across levels of government as is project co-financing |

Notes: While cantons have certain powers, they tend to be of small size and not an appropriate scale for many innovation instruments.

The New Regional Policy in Switzerland increasingly supports innovation-related investments as part of its efforts to increase the economic strength of regions, in particular those that are disadvantaged.

Table 7.39. **Instruments by level of government**

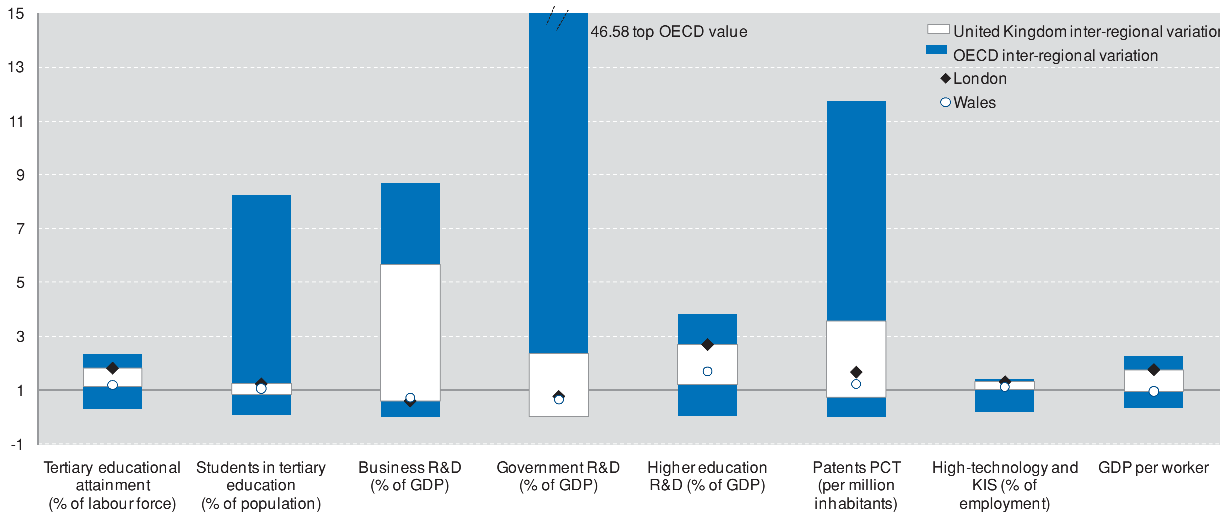
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | | |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | | |
| Competitive R&D funding by PRCs or HEIs | X | |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | S |
| Multi-disciplinary technology platforms | | |
| Science and technology parks | X | S |
| Incubators for new firms | X | S |
| **Financing for innovative firms** | | |
| Public development banks | X | |
| Public venture capital funds or stakes in private funds | X | |
| Guarantees | X | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | |
| Foreign firms eligible for public innovation-related funds | X | |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | | |
| Innovation awards | | |

Notes: PRC=public research centre; HEI=higher education institution.

## United Kingdom

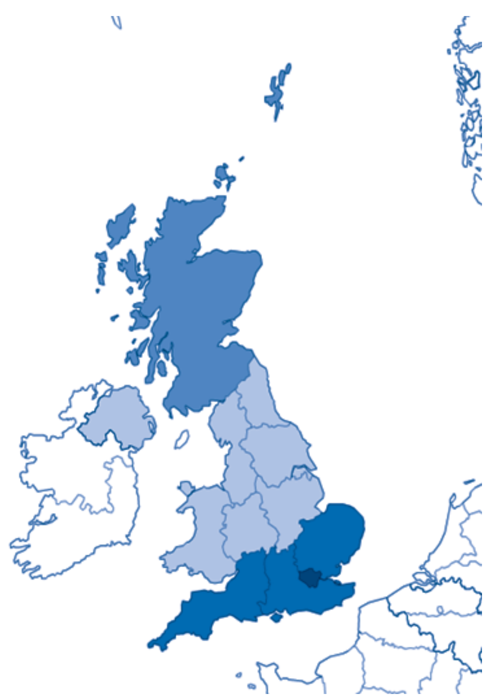
Figure 7.39. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.40. **Categorisation of OECD regions in country**



**Knowledge intensive city/capital districts:**

London

**Knowledge and technology hubs:**

Eastern, South East, South West

**Service and natural resource regions in knowledge-intensive countries:**

Scotland

**Medium-tech manufacturing and service providers:**

North East, North West (Including Merseyside), East Midlands, West Midlands, Yorkshire and Humberside, Wales, Northern Ireland

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.40. **Overview of multi-level governance of STI policy (England)**

| | |
|---|---|
| Regions | 9 Government Office regions for England |
| Country structure | Unitary, regions not elected |
| Sub-national share of government expenditure, all functions (2009) | 27.5% (UK total, including three Developed Administrations of Scotland, Wales and Northern Ireland) |
| Definition of regional role in STI | Regional Development Act 1998 (2010 election may result in changes) |
| Regional role in higher education | Not a regional responsibility |
| Formal national-regional co-ordination bodies | On STI, the Technology Strategy Board has become a *de facto* co-ordinating body with regional science and industry councils/ regional development agencies (RDAs) |
| Regional consideration in national S&T/Innovation Plan | Science and Innovation Investment Framework (2004) discusses partnership across levels of government. Three modalities for regional entities to deliver policy include: *i)* regional delivery with national advice and direction; *ii)* national delivery with regional advice and input; and *iii)* inter-regional partnership across RDAs |
| Example of national policies with explicit regional dimension | None reported |
| Example of co-ordination tools | With English regions, there are a number of vehicles for consultation and ongoing dialogue. Contracts and project co-financing are also used. Government Offices in each region exist, but do not address co-ordination on S&T and innovation activity. |

Notes: The Devolved Administrations in the United Kingdom (Scotland, Wales and Northern Ireland) have a different degree of decentralisation of STI in the context of their status as entities with greater autonomy. For example, they finance their higher education institutions and have greater levels of funding for STI-related programmes and instruments than an English region.

Table 7.41. **Instruments by level of government (England)**

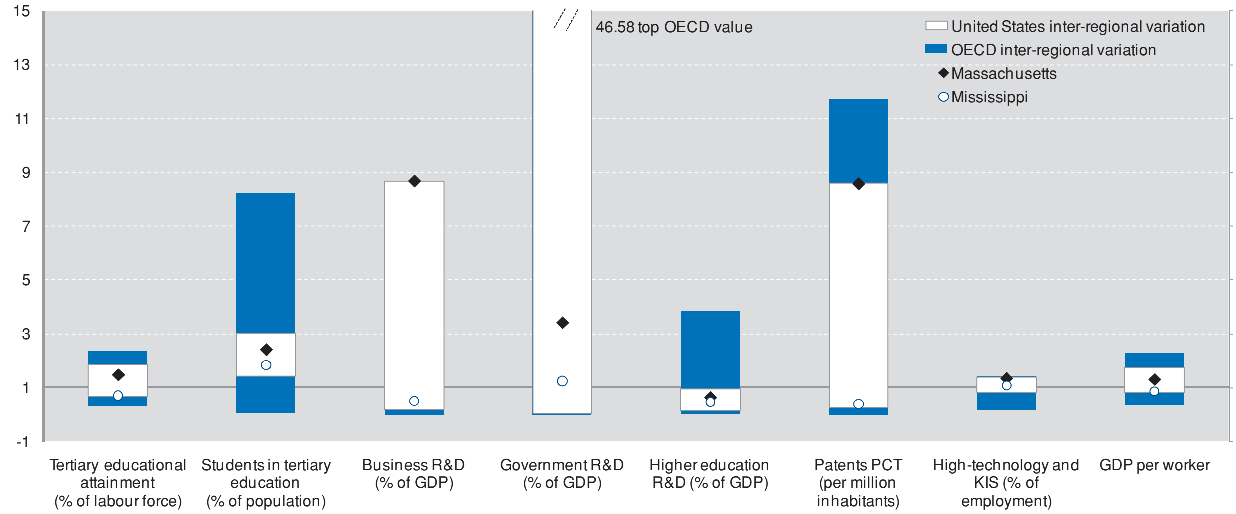
N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | |
| Targeted human resource training (directly, subsidies) | X | |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | X |
| Technology foresight exercises (assessing future needs) | X | X |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | X |
| Seed funding/projects to start PRCs or HEIs | X | S |
| Competitive R&D funding by PRCs or HEIs | X | |
| Public subsidies for private R&D | X | |
| Tax credits for private R&D | X | |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | X |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | X |
| Advisory to spin-off and knowledge-intensive start-up firms | | X |
| Other technology transfer centres and extension programmes | | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | X |
| Multi-disciplinary technology platforms | X | X |
| Science and technology parks | X | X |
| Incubators for new firms | | X |
| **Financing for innovative firms** | | |
| Public development banks | | |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | X | |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | X |
| Foreign firms eligible for public innovation-related funds | | |
| International trips to develop innovation networks | X | S |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | S |
| Innovation awards | X | S |

Notes: PRC=public research centre; HEI=higher education institution.

## United States

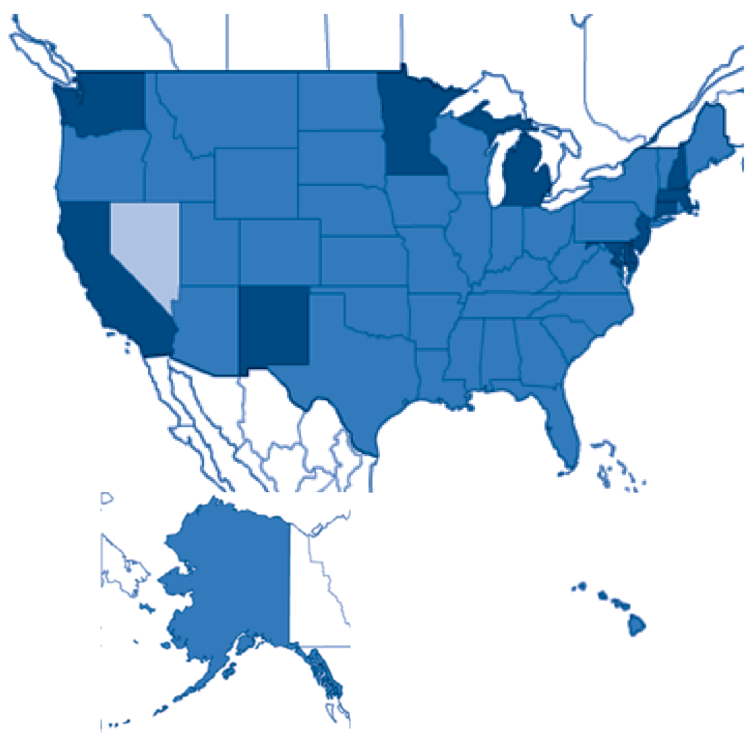
Figure 7.41. **Summary of innovation indicators: inter-regional variation**




Notes: Data is for 2007 or latest year available. Each variable is normalised to an OECD median of 1 for regions with data. The light colour band represents the range of values for the country. The dark band represents the range of values for OECD regions. Not all OECD regions have data for all variables.

*Source:* Calculations based on data from the *OECD Regional Database*.

Figure 7.42. **Categorisation of OECD regions in country**



**Knowledge intensive city/capital districts:**

District of Columbia

**Knowledge and technology hubs**:

California, Connecticut, Delaware, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, Washington

**US states with average S&T performance:**

Alabama, Alaska, Arizona, Arkansas, Colorado, Florida, Georgia, Hawaii, Idaho, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Mississippi, Missouri, Montana, Nebraska, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Texas, Tennessee, Utah, Vermont, Virginia, West Virginia, Wisconsin, Wyoming

**Traditional manufacturing centres:**

Nevada

Note: Colours range from dark to light based on the type of region present in the country with available data. This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

*Source:* Calculations based on data from the *OECD Regional Database*.

Table 7.42. **Overview of multi-level governance of STI policy**

| | |
|---|---|
| Regions | 50 states and 1 district |
| Country structure | Federal |
| Sub-national share of government expenditure, all functions (2009) | 48.8% |
| Definition of regional role in STI | State and county/city economic development |
| Regional role in higher education | Responsibility of the states; federal funding sources for research |
| Formal national-regional co-ordination bodies | White House Office of Science and Technology Policy; US House Committee on Science, Space and Technology; Multiple NGOs (i.e., National Governors Association; State Science and Technology Institute; Council on Competitiveness; American Association for the Advancement of Science) |
| Regional consideration in national S&T/Innovation Plan | "A Strategy for American Innovation: Securing Our Economic Growth and Prosperity" http://www.whitehouse.gov/innovation/strategy |
| Example of national policies with explicit regional dimension | EPSCOR (for building research capacity in lesser developed states); Regional Innovation Clusters; i6 Challenge |
| Example of co-ordination tools | Harvard Cluster Mapping Project to identify clusters relevant for national and regional needs |

Table 7.43. **Instruments by level of government**

N=national, R=regional; X=most or all; S=some

| | N | R |
|---|---|---|
| **Human capital investment** | | |
| Scholarships for post-graduate studies | X | S |
| Targeted human resource training (directly, subsidies) | X | S |
| **Strategy and foresight** | | |
| High-level strategic advisory body | X | S |
| Technology foresight exercises (assessing future needs) | X | S |
| **R&D investment (including large infrastructure)** | | |
| On-going institutional R&D funding in PRCs or HEIs | X | S |
| Seed funding/projects to start PRCs or HEIs | X | S |
| Competitive R&D funding by PRCs or HEIs | X | S |
| Public subsidies for private R&D | X | S |
| Tax credits for private R&D | X | S |
| **Technology transfer and innovation services to firms** | | |
| Quality control and metrology services | X | S |
| Innovation advisory or support services (publicly provided, vouchers, subsidies, student placements) | X | S |
| Advisory to spin-off and knowledge-intensive start-up firms | X | X |
| Other technology transfer centres and extension programmes | X | X |
| **Innovation collaboration** | | |
| Cluster initiatives (often sectoral and mainly firm-based) | X | X |
| Branded excellence poles or hubs (label and multiple actors) | X | S |
| Multi-disciplinary technology platforms | X | S |
| Science and technology parks | X | X |
| Incubators for new firms | X | X |
| **Financing for innovative firms** | | |
| Public development banks | X | S |
| Public venture capital funds or stakes in private funds | X | S |
| Guarantees | X | S |
| **International collaboration** | | |
| Scientific co-operation for HEIs and PRCs | X | S |
| Foreign firms eligible for public innovation-related funds | X | S |
| International trips to develop innovation networks | X | X |
| **Other programmes** | | |
| Public procurement policy with innovation focus | X | S |
| Innovation awards | X | S |

Notes: PRC=public research centre; HEI=higher education institution.

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