Innovation-driven Growth in Regions: The Role of Smart Specialisation

PRELIMINARY VERSION

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FOREWORD

This report brings together the key findings from the OECD Committee for Scientific and Technological Policy (CSTP) activity 2.4 on smart specialisation strategies for innovation driven growth carried out under the auspices of the Working Party on Innovation and Technology Policy (TIP). The report has been prepared by the OECD Secretariat (Inmaculada Perianez-Forte and Mario Cervantes) and national experts who authored the case studies. Dominique Guellec, Head of the Country Studies and Outlook Division, provided overall guidance and support for the project which benefited from inputs and comments from members of its Steering Group, namely Armin Mahr (Austria), Jan Larosse (Belgium) Raine Hermans (Finland) and Jeong Hyop Lee (Korea). Special thanks are also extended also to the European Commission, notably the DG Regio (Mikel Landabaso, Katja Reppe and Luisa Sanches) and the working team of S3 platform of the IPTS. The report draws on the analytical work carried out by ECOOM (Koenraad Debackere, Petra Andries), the Joanneum Research Graz (Christian Hartmann), Technopolis Group (Patries Boekholt) and the comments received by experts, including Dominique Foray, Philip McCann, Raquel Ortega, Claire Nauwelaers, Alessandro Rosiello and Michele Mastroeni and Dimitrios Pontikakis. In addition to the voluntary and in-kind contributions from the participating countries, the activity also benefited from a grant from DG-Regio of the European Commission which is gratefully acknowledged.

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PART I – SYNTHESIS

This synthesis chapter is based on a review of the literature on smart specialisation and its underlying concepts; the identification and development of indicators and metrics for smart specialisation strategies; an enquiry of governance and priority setting processes; and findings of the 15 case studies of country and regional experience in designing and implementing smart specialisation strategies.

EXECUTIVE SUMMARY

Introduction: From concept to policy framework

In November 2009, the European Commission published the report “Knowledge for Growth”, the results of an expert advisory group to the EU. Tasked with finding an alternative to public policies that were seen to spread public investments in knowledge and innovation – research, education, public support to business R&D, etc – thinly across technology research fields such as biotechnology, ICTs, and nanotechnology, the expert group proposed that national and, especially, regional governments should encourage investment in domains that would “complement the country’s other productive assets to create future domestic capability and interregional comparative advantage”. This strategic proposal was coined “smart specialisation” and it spread quickly and was adopted in the EU 2020 Agenda with its objectives of smart, sustainable and inclusive growth. Indeed, Research and Innovation Strategies for Smart Specialisation (RIS3) are proposed as an *ex-ante* conditionality for future EU Structural Fund Programmes[1] with a view to concentrate resources on research and innovation to maximize the impacts of the structural funds. However, the issues raised by smart specialisation go far beyond the discussion in the EU context. A number of countries, within OECD or not, are now taking interest in Smart Specialisation as one way to lead their economies out of the crisis by leveraging regional dynamism in innovation led/knowledge-intensive economic development.

Although initially relatively simple as a concept – the concentration of public resources in knowledge investments on particular activities in order to strengthen comparative advantage in existing or new areas – the conceptual and policy implications of smart specialisation are far more complex and transcend three distinct areas: *i)* the underlying role of scientific, technological and economic specialisation in the development of comparative advantage and more broadly in driving economic growth; *ii)* policy intelligence for identifying domains of present or future comparative advantage and; *iii)* governance arrangements that give a pivotal role to regions, private stakeholders and entrepreneurs in the process of translating specialisation strategies into economic and social outcomes.

In this sense, smart specialisation is a regional policy framework for innovation driven growth. That said, many of the underlying elements of the smart specialisation approach are not new and have been part of the broader discussion on innovation, industrial policies and regional economic development for some time.

What distinguishes smart specialisation from traditional industrial and innovation policies is mainly the process defined as “entrepreneurial discovery” - an interactive process in which market forces and the private sector are discovering and producing information about new activities and the government assesses the outcomes and empowers those actors most capable of realising the potential (Foray, 2012; Hausmann and Rodrick 2003). Hence smart specialisation strategies are much more bottom-up than traditional industrial policies. In addition, the focus of the choices is on the “enabling knowledge-based assets”, both public (e.g. education, public research) and private, not on particular industries. This more upstream approach gives more of a margin for the market to determine and lead on downstream choices. Still, the operationalisation of entrepreneurial discovery processes from a policy perspective is a major challenge and requires the collection and analysis of diverse information that often is held by entrepreneurs themselves or embedded in firms and public institutions. Incentives and instruments for disclosing – passively or actively – this information (e.g. through stakeholder consultations, public-private partnerships, IPRs) will be key.

Like traditional industrial policy, smart specialisation strategies aim to address market/systems and co-ordination failures. But traditional industrial policies required significant levels of information to justify subsidy support and they tended to be implemented in vertically integrated sectors with stable technological paradigms. In contrast, smart specialisation recognises the lack of perfect information, the level of advancement of a given activity, and the relative risks for policy. It thus focuses on helping entrepreneurs identify their knowledge-based strengths at the regional level and in a more exploratory approach in which public decision makers listen to market signals using a range of assessment tools (e.g. SWOT analysis, surveys) and mechanisms such as public-private partnerships, technology foresight and roadmapping to name a few.

Risks of policy induced specialisation

While the central tenet of the concept of smart specialisation was quickly accepted by the EU policy community, especially with a view to increasing synergies and avoiding duplication in national and EU research and innovation funding, the implicit idea of policy-induced specialisation in innovation have raised concerns amongst economists and others inside and outside the EU policy circles (Pontikakis, D. et al. 2009). First among these are the problems of:

Government picking winners: To what extent does smart specialisation lead governments to favour some R&D/technology and innovation activities at the expense of a market-driven allocation of resources? Indeed, experience with industrial policy in OECD countries has shown that any policy involving “picking winners” - such as supporting firms to produce renewable energy technologies through subsidies or taxes is difficult to implement and could be wasteful from a social welfare point of view (e.g. to the extent that some activities would have been undertaken even in the absence of policies), and could lock in inefficient activities and encourage rent-seeking.

Competition effects: Another important concern is the prescription for a policy-induced division of labour between leading and lagging regions due to assumptions about the role of technology in traditional or leading edge sectors. A policy that targets public R&D towards an area of existing strength, such as agriculture, may deepen interregional disparities though the reduction of competition and market/merit based selection. Indeed, some “duplication” is a side-effect of competition and may be beneficial from a societal point of view.

Diminishing returns: Another concern that arises from the concentration of R&D investments is that of the “diminishing returns” to R&D.

To allay some of the concerns about “smart specialisation” scholars and policy advocates point out that it is a vertically-oriented policy framework for priority setting at the regional level that combines bottom-up and top down process in priority setting for public investments in knowledge. They also point out that smart specialisation depends on good general framework policies (e.g. competition, trade policy, labour market policy and education and skills) and horizontal innovation policies (e.g. R&D tax credits).A smart specialisation strategy means that government efforts and resources don’t all go to the same extent to all activities: that concerns various types of support to innovation, but also other involvement with industry, education etc. An important issue is then how to select the relevant areas where government will focus its effort. The main principles of the smart specialisation framework can be summarised as follows:

Concentration of public investments in R&D and knowledge on particular activities is crucial for regions/countries that are not leaders in any of the major science or technology domains. Past policies tended to spread “knowledge investment” (e.g. high education and vocational training, public and private R&D) too thinly, not making much of an impact in any one area. However, concentration in the smart specialisation context is about focusing knowledge investments on ‘activities’ – those ‘business functions’ carried out by firms which range from the conception of a product to its end use and beyond (e.g. design, production, marketing, distribution and support to the final consumer) (Porter, 1986; Gereffi et al., 2001). These ‘activities’ (e.g. goods or services) may be undertaken by a single firm or divided among different (supplier) firms and be concentrated within one location or spread out over global value chains (OECD, 2012a). The emerging feature of many of these activities is that they increasingly cut across established sectors and industries.

Smart specialisation relies on an entrepreneurial process of discovery that can reveal domains of economic activity where a country or region excels or has the potential to excel in the future. It empowers entrepreneurs who are able to combine the necessary knowledge about science, technology and engineering with knowledge of market growth and potential in order to identify the most promising activities. In this learning process, entrepreneurial actors have to play the leading role in discovering promising areas of future specialisation, because the needed adaptations to local skills, materials, environmental conditions, and market access conditions are unlikely to be able to draw on codified, publicly shared knowledge, and instead will entail gathering localised *information and the formation of social capital assets.* One implication for policy makers is that this requires ensuring policy tools to collect the “entrepreneurial knowledge” embedded in the region to transform it into policy priorities. In this context, entrepreneurial actors are not only the people creating new companies but also innovators in established companies, in academia or in the public sector.

Specialised diversification: specialisation on the selected activities (out of a related variety) that provide comparative advantage based on differentiation of their operations and products in global markets.

The specific properties of General Purpose Technologies (GPTs) underlie the logic of “smart specialisation”[2]. Invention of a GPT extends the frontier of invention possibilities for the whole economy, while the “co-invention of applications” changes the production function of a particular sector. GPTs *are important for upgrading upstream and downstream of the value* chain. The leading regions invest in the invention of a GPT or the combination of different GPTs (e.g. bioinformatics). Regions do not need to “lead” in these technologies to benefit. In fact, follower regions often are better advised to invest in the “co-invention of applications” around a GPTs. Benefiting from GPTs generally also requires alignment with education and training policies in order to build capacity.

Multi-governance and inter-regional policy co-ordination: setting common goals for drawing up regional strategies and to allocate public funding accordingly. Smart specialisation strategies are interlinked by nature through complementary activities at horizontal level and require horizontal policy coordination. But they are in particular co-defined by the ‘vertical’ alignment of entrepreneurial activity, partnering in clusters, regional development strategy and interregional and international arrangements that all are part of a multi-level governance structure for smart specialisation. Setting common goals therefore constitutes a powerful governance mechanism for the vertical alignment of these strategies, without jeopardising a market-oriented process of resource allocation. This multi-level governance co-ordination requires the synchronisation of both national strategies with regional strategies and the synchronisation of different regional strategies (e.g. innovation strategies, research strategies, industrial strategies), to support regional priorities.

Patterns for structural change: Structural change, not just the accumulation of capital, is a driver of economic growth. As such smart specialisation aims to accelerate structural change by encouraging the transformation of economic activities from a structural perspective. It may in some cases mean modernising existing industries or enabling lagging sectors to improve their competitiveness through the adoption of ICTs, but for front runner countries it can also mean developing new areas at the edge of the technological frontier (e.g. radical formation).

The global economic context for smart specialisation

Since 2009, and following the aftermath of the global financial and economic crisis, including the current euro debt crisis, the concept of smart specialisation has found an echo in the OECD discussions on "New Industrial Policy", "New Sources of Growth" and "New Approaches to Economic Challenges". Indeed, the OECD has exhorted countries to "go structural" to make economies more competitive; to "go social" to address the increased inequality and lack of jobs; to "go green" to promote a growth path that takes due account of environmental constraints; and to "go institutional" to address the current confidence gap in institutions and markets. Smart specialisation is one several frameworks that accommodates many of these goals by focusing on promoting structural change in the economy through investments in knowledge-based assets and better governance in STI policy making. Although smart specialisation has arisen in the EU context of market integration, regional cohesion and the European Research Area, similar strategies are based on targeting of public investments and top-down and bottom up initiatives are visible in regions and states as varied as in Australia, Michigan or California in the United States as well as Korea and Singapore.

Strategies for concentrating investments in knowledge-based assets on particular activities through an entrepreneurial-led process have also found fertile ground at the OECD as the result of a confluence of different developments. On the one hand, many OECD countries have entered a period of slow growth, high unemployment, and low demand and high public deficits. And innovation is thus seen a key to re-start growth and investment. General purpose technologies (GPTs) in particular are seen as way to revitalise existing industries and to stimulate innovation downstream including innovation in services (e.g. ICT services for public health).

On the other hand, globalisation and advances in ICT allow firms to fragment their production in the global value chain. As a result, the relevant unit in the economic analyses is not the industry or sector but the 'business function' or 'activity' along the supply chain (e.g. design, R&D, procurement, operations, marketing, and customer services). Countries tend to specialize in specific 'business functions' or 'activities' rather than specific industries (e.g. assembly operations for China or business services for India). This rise of GVC illustrates why specialisation no longer takes place solely in industries but in specific functions or activities in the value chain (OECD, 2012a).

At the same time, the crisis has also exposed the vulnerability of global value chains to demand and supply shocks and has also forced OECD governments to look more closely at where economic value is created along global value chains, and whether knowledge spill-overs can be captured locally by enhancing linkages between local and foreign actors. Place-based growth is seen as particularly important for innovation given the weight of agglomeration economies (OECD 2011). The smart specialisation approach responds to the need to better position regions/regional clusters in global value chains but also, for those regions where it is more relevant, in local and regional production systems.

Key policy findings

The OECD project on smart specialisation, organised around several modules - a theoretical and empirical literature review, detailed economic and technological specialisation profiles of regions and countries, a survey of governance mechanisms for smart specialisation in self-selected countries and country case studies - has generated a rich amount of material. Some of the key policy messages include:

- **Policies for entrepreneurial discovery.** The smart specialisation approach calls for an 'entrepreneurial selection' of market opportunities (e.g. to minimise failures and to avoid ill-informed policy decisions). In practice, this means the promotion of entrepreneurship across the board. While successful companies will constitute the new specialisation of the country/region (self-discovery), the role for policy is to develop a flexible strategy focusing on measurable intermediate goals, identifying bottlenecks and market failures and ensuring feed-back into policy learning processes. But the smart specialisation approach goes further, it suggests the need to consider incentives (e.g. IPR, prizes) to reward those entrepreneurs who discover new domains and activities and incentives (e.g. lead markets, public procurement) to attract other agents and firms and facilitate entries so that agglomeration and scale effects materialise at a later stage (Foray, 2012). One important challenge concerns how governments deal with the "de-selection" or the abandonment of support to certain activities.

- **Promoting General Purpose Technology platforms and networks**. Given the range of applications of general purpose technologies, technology platforms involving public and private actors but also standards settings organisation can leverage productivity in existing sectors or help reveal or identify sectors in which to concentrate resources. Not all regions need to possess leadership in these technologies to benefit. Indeed, they can purchase or access such platforms from the market in neighbouring regions or abroad. Follower regions, however, may be better advised to invest in the "co-invention of applications" around a GPTs. Benefiting from GPTs generally also requires alignment with education and training policies in order to build capacity.

- **Diagnostic and indicator based tools and infrastructure.** The TIP project has demonstrated that smart specialisation requires regions and countries to maintain an infrastructure and indicator base. It has also shown that for most technological domains, there is a match between the technological and the economic performance. However, there are cases where some domains are economically strong in country but technological revealed comparative advantage (RCA) is relatively weak. For example, Upper Austria has strengthened its educational and research base in Mechatronics and Plastics to match demonstrated industrial needs (Upper Austria 2011).This information could help policy makers assess the sustainability of traditionally strong sectors, or it may inspire them to focus support on areas where research capacity is strong but economically weak, or even on activities yet non-existent but which match well with existing capabilities in the region. In addition to quantitative indicators, *qualitative* data such as SWOT analyses, surveys, workshops and interviews with regional stakeholders are also important in the priority setting and discovery process. Some leading OECD regions are using very sophisticated tools to assess priority areas (e.g. Lower Austria's Innovation Assessment Methodology) as well as sophisticated policy monitoring tools to assess impacts at both programme and regional level (e.g. the annual Brainport Monitor). Lessons from the OECD case studies for the project show this kind of capacity takes time and cannot be easily improvised.

- **Strategic governance for smart specialisation.** Three types of strategic capacities are needed to grasp future opportunities: the capacity to identify local strengths; the ability to align policy actions and to build critical mass; and the ability of regions to develop a vision and implement the strategy. The role of strategic policy intelligence as a tool for governance of smart specialisation is therefore important. In practice, the link between policy instruments and the priority setting is not explicit in the vast majority of regions and countries. Many policy makers find it difficult to move from the "priority setting process" to the process of developing policy instruments and the corresponding budget. In most cases, the prioritisation process is disconnected from the budgetary process. Additional governance challenges including building channels for two-way communication and having skilled personnel in agencies and ministry (e.g. in Estonia, efforts are focused on engaging ministries and industry in the governance of the national innovation system more actively to ensure synchronised implementation and coordination of policies). The latter is especially a challenge for smaller and remote regions, and especially context of constraints on public finances and public sector employment.

- **Openness to other regions:** the specialisation strategy of regions should integrate the fact that other regions are also involved in knowledge creating activities and that duplication (the “not invented here” syndrome) might lead to lower effectiveness and finally failure. Hence, co-operation with other regions with complementary capabilities and strategies is to be sought (e.g. the cross-border cooperation of Brainport Eindhoven Region in the Netherlands with Leuven in Belgium on ICT and LifeTec&Health).

THE IDEA OF SMART SPECIALISATION

Smart specialisation is a industrial and innovation framework for regional economies that aims to illustrate how public policies, framework conditions, but especially R&D and innovation investment policies can influence economic, scientific and technological specialisation of a region and consequently its productivity, competitiveness and economic growth path. It is a logical continuation in the process of deepening, diversifying and specialising of more general innovation strategies, taking into account regional specifities and inter-regional aspects, and thus a possible way to help advanced OECD economies – as well as emerging economies- restart economic growth by leveraging innovation led/knowledge-based investments in regions.

Introduction

Genesis of smart specialisation as an STI policy relevant concept

Smart specialisation has emerged as relevant concept and policy agenda for science, technology and innovation against the background of important changes in the structure of OECD economies. These economic changes are the result of both long-term and structural trends (e.g. the diffusion of ICTs, the rising supply of R&D and human capital and other knowledge-based assets, globalisation of production systems but also of business R&D, the rise of services and of new global players in STI such as China and India) and shorter-term developments such as fiscal austerity in OECD countries and quests for savings in public spending; the devolution of national innovation policy prerogatives to specialised agencies (public or private) and to regional governments; the (re) emergence of "new" industrial policy with a focus on revitalising manufacturing production activities in OECD countries.

The genesis of the concept can be traced back to the work of Dominique Foray and Bart van Ark and other members of the "Knowledge for Growth", an EU expert group tasked with finding an alternative to public policies that spread public investments in knowledge and innovation – research, education, public support to business R&D, etc. thinly across technology research fields such as biotechnology, ICTs, and nanotechnology. A central tenet of the smart specialisation argument advanced by Foray and others is that governments should focus their knowledge investments in activities– not in sectors in *per se* – that reflect areas where a region or country has some comparative advantage (specialisation) or emerging areas where entrepreneurs could develop new activities (diversification). This connection between specialisation and technological diversification in the context of regional development and growth has been highly influential as it demonstrated that the smart specialisation as policy framework is very well suited for dealing with the problems of place-based growth (McCann, P. and Ortega-Argiles, R., 2013 forthcoming).

The principles behind smart specialisation rapidly became a central element of the Europe 2020 Strategy and smart specialisation strategies have been incorporated as an *ex ante* condition for regions in the *Regional Policy Contributing to Smart Growth in Europe* [COM(2010)553] to access the European Fund for Regional Development (ERDF) which account for EUR 201 billion, for the period 2007-2013 and of which EUR 65 billion are spent for innovation (the total investment for innovation in this period from Cohesion Policy being EUR 86 billion considering also the European Social Fund). European regions are therefore required to identify the key areas, activities or technological domains where they are more likely to enjoy competitive advantage and focus their regional policies to promote innovation in these fields.

The OECD project on smart specialisation, led by the Working Party on Innovation and Technology Policy (TIP), has sought to contribute to the conceptual framework for smart specialisation by exploring the boundaries of smart specialisation for regions and countries; to define the rationales for policy intervention (e.g. knowledge spill-overs, co-ordination, and competition failures but also opportunities to shift the direction of innovation towards global challenges); and to help build the policy tools for smart specialisation and to identify the key elements of STI governance frameworks that might need to change to accommodate smart specialisation strategies. On the operational side, the TIP project also aims to, based on analysis of indicators and policy governance, identify good practices in policy development, methodologies and selection criteria for designing, implementing and evaluating smart specialisation strategies in (self-) selected OECD regions and countries.

Characteristics of smart specialisation

The theoretical origins of smart specialisation are deep and are grounded in the classical economic theories of economic growth (e.g. the theory of the division of labour by Adam Smith) and notably trade specialisation. Modern recent strands of economic thought from evolutionary economics to the economics of agglomeration are also visible in the smart specialisation concept, notably the issue of increasing returns to knowledge, the role of knowledge spill-overs and rigidities (e.g. labour market barriers) that prevent shifts in specialisation patterns. Smart specialisation also draws on the broad economic research on industrial development [e.g. Marshallian externalities, industrial districts; flexible specialisation (Piore and Sabel, Storper), and neoclassical spatial economics (Krugman and Venables)].

Smart specialisation thus is very much an *economic* framework focussed on regions that aims to illustrate – for the purpose of policy making – how public policies, framework conditions, but especially R&D and innovation investment policies – can influence economic, scientific and technological specialisation within a regional policy framework and through this mechanism, productivity, competitiveness and economic growth. Another important feature of the smart specialisation concept is that through policy interventions focused on releasing entrepreneurial forces, it aims to impact not only on the rate but also the direction of innovation.

The core elements of the smart specialisation concept for policy include:

- **Self-discovery or entrepreneurial discovery process**. Prioritisation is no longer the exclusive role of the state planner (top down) but involves an interactive process in which the private sector is discovering and producing information about new activities and the government provides conditions for the search to happen, assesses potential and empowers those actors most capable of realizing the potentials. But entrepreneurship in the knowledge economy recognises that value added is also generated outside sole ownership, in spillovers, in networks of complementarity and comparative advantage. These are the two sides of the smart specialisation coin. Implicit in this is the need for better co-ordination mechanisms between regions and national governments for allocating resources in an environment of structural change and uncertainty, risk, and information asymmetries.

- **Activities, not sectors *per se* are the level for setting priority setting for knowledge investments.** While sectors still matter, the issue is not to target sectors but rather activities. Activities can be tied to specific technologies or the technology mix, to specific capabilities, natural assets etc. In general what is discovered as future priorities are those activities where innovative projects complement existing productive assets, hence the need to differentiate the target of smart specialisation according to the overall position of a given activity (e.g. modernisation, transition, diversification, radical foundation and the key notion of related diversity).

- **Smart specialisation entails strategic and specialised diversification.** Rather than encouraging specialisation along pre-determined paths, the smart specialisation approach recognises that new or unexpected discoveries of activities might emerge within a given parts of an innovation system leading to “specialised” diversification.

- **Evaluation and monitoring.** As other versions of new industrial policies, smart specialisation emphasises the need for policy makers to carry out evidence-based monitoring and evaluation and to feed-back into policy design. It also requires flexibility in **policy making to be able to** terminate or reallocate public support to R&D and innovation. For that purpose, **clear benchmarks and criteria for success and failure are needed.** Smart specialisation policies need to have measurable goals, whether it involves an increase in business R&D, R&D commercialisation or research excellence.

The EU has translated these principles of smart specialisation into operational elements of regional innovation strategies Regional innovation strategies for smart specialisation are integrated, place-based transformation strategies that:

- concentrate public resources on innovation and development priorities, challenges and needs;

- outline measures to stimulate private RTD investment;

- build on a region's capabilities, competences, competitive advantages and potential for excellence in a global perspective;

- foster stakeholder engagement and encourage governance innovation and experimentation;

- are evidence-based and include sound monitoring and evaluation systems.

From “picking winners” to facilitating and supporting entrepreneurial self- discovery in regions

The central element of the smart specialisation concept that differentiates it from traditional innovation and industry policy frameworks is the focus on the ‘entrepreneurial discovery process’ or ‘self-discovery’ which is the process through which an entrepreneur realises that a good or activity, that may or may not already exist in other regions, can be produced locally, with some variations and possibly at lower cost (Rodrik D., 2004). The entrepreneur is able to ‘discover’ new activities by combining existing scientific and technical knowledge (e.g. ICTs or nanotechnology) with the industrial resources and capacities in the region (e.g. local knowledge) that can lead to new economic opportunities. This new process of 'self-discovery' will also hopefully lead away from imitation and me-too strategies that characterised many regional innovation strategies in the past decade. Furthermore, empirical evidence shows that despite similar endowments, countries and regions may specialise (through the self-discovery process – for example by applying the same technology to the local conditions) in very different activities (Sabel Charles et al. 2010).

One of the longstanding problems of governments seeking to be strategic in their targeting of industrial policies or innovation polices has been the lack of information on the market, the technology, and capacities of institution. The advances in ICT, the increase in human capital in public administrations and closer public-private interactions between industry and government at various stages and levels of policy making (e.g. from foresight exercises to concrete public-private partnerships) have increased the amount of information as well as the incentives for disclosing information that underlies strategic policy intelligence. Smart specialisation strategies are thus enabled by new capabilities in national and regional administrations but also by the release of information previously embedded in the market and institutions.

Box 1.1. How to use Smart Specialisation diagnostics in the evaluation process

The selection of a smart specialisation field should only take place when local entrepreneurial commitment and development have already achieved a sufficient level of stability and coherence.

At that point in time, policy makers should decide whether and how to support these entrepreneurial processes, engaging in and committing to a process of policy learning and deployment.

Both diagnostic tools and indicators should therefore not be used to select priorities in a top-down manner, but rather to monitor the entrepreneurial discovery and policy learning processes.

Instead, diagnosing apparent strengths, weaknesses, fits and misfits in terms of scientific, technological, innovative and economic capabilities will allow policy makers and funding agencies to ask the right questions when evaluating and deciding whether or not to support specific entrepreneurial processes.

In this evaluation process, all entrepreneurial actors including firms, but also universities and research centres should be engaged. Engaging them will not only allow policy makers to develop a deeper insight into the matches and mismatches of their specialisations, but it will also initiate and nurture the necessary collaboration efforts among these different actors.

If the evaluation exercise shows that some specific capabilities are missing, one should look across the borders of the region or country and see whether interregional and international collaborations with stronger partners can be set up. The global value chain perspective offers a valuable framework to support the attendant discovery and learning processes.

Source : ECOOM - Centre for Research & Development Monitoring at Leuven University

Here, the role of government intervention is important but it is subsidiary. Policy intervention is required not to select the areas or activities for investing public resources (Foray D. et al., 2009) but to facilitate this ‘discovery’ to occur and to be supported (e.g. by providing incentives, removing regulatory constraints). Governments should create the necessary conditions, environment, dynamics and structures through which entrepreneurs and government learn about costs and opportunities and engage in strategic coordination (Rodrik D., 2004). To illustrate, this could mean justifying public support for “exploring” the opportunities from applying GPT technologies to existing industries (e.g. via demonstration projects, training).

Another characteristic of the smart specialisation approach is that it aims to deal with one of the weaknesses of government intervention in industrial and innovation policy, that is the “diffused agency” problem since it focuses on entrepreneurs and co-ordination of policy over a broad range of stakeholders (regions, national actors) and between *top-down* and *bottom-up* initiatives (See Box 2 and Chapter 4).

Box 1.2. Examples of bottom-up initiatives to foster entrepreneurial discovery

In Alicante (Spain), a new civil society organisation has emerged proposing projects focused on radical specialisation where a discovery is followed by a firm compromise of a critical mass of citizens who become actors, then protagonists, then authors and then co-authors. As an example, one of these projects is focused on the development of a classic guitar culture, where at least ten sub-projects closely linked have emerged, proposing different business opportunities related to education, tourism, performance, guitar building, museum, recording, research or publishing. This citizen and business driven initiative is the consequence of the severe impact of the crisis in Spain which has brought to a collapse of the traditional business models, highly subsidised in the past: tourism, construction and industrial production.

These citizen and business driven initiatives propose a radical change of paradigm, where public investment is located only where a consolidated project is already in place, following strictly a low cost philosophy. Projects are structured following a "neuronal" approach, where different private and business stakeholders assume direct responsibility on specific sub-projects and a platform provides full information of the development of the different initiatives. Results are measured upon the degree of cross-fertilization amongst the projects and the potential and actual market and job opportunities created, while the role of the public institutions is limited to provide support and co-operate in the creation of the minimum structures needed.

Source: OECD (2012). Interview with Prof. Manuel Desantes from the University of Alicante

Articulation between smart specialisation and cluster policy

Clusters are important building blocks of a smart specialisation strategy.[3] Indeed, cluster dynamics are a force for the economic, industrial and technological specialisation of a region or country. The main rationale for public policies to promote clusters through infrastructure and knowledge-based investments, networking activities and training, is an increase in knowledge spillovers among actors in clusters and thus the generation of a collective pool of knowledge that results in higher productivity, more innovation and an increase in the competitiveness of firms. Many OECD and non-member countries have programmes to promote the creation of new clusters or to strengthen existing clusters. Cluster policies in many ways aim to achieve an "implicit" strategy for specialisation. For example, cluster policies in many countries from France to the United States explicitly targeted specific sectors/industries in their national innovation strategies or plans.

While offering a specific way of activating the spillover and networking effects of cluster policies (entrepreneurial discovery), policies for smart specialisation aim also to go beyond these policies, by emphasising the interaction between framework conditions and vertical innovation policies needed to accelerate *structural change,* notably by deepening existing capabilities and creating new capacities (Navarro M., et al., 2012). Key to this goal is the emphasis of cluster development around key enabling technologies (e.g. information and communication technologies [ICTs], biotechnology, nanotechnology). Likewise, clusters should be grounded on technological fields with sufficient regional substance and a broad potential to absorb novel entrepreneurial activities (e.g. Upper Austria's plastics cluster is branching out and actively promoting the upcoming high-tech industry in lightweight materials). Seen from this perspective, smart specialisation offers a tool kit of policy interventions to address co-ordination and market failures at regional level while mobilising general purpose technologies to help scale up activities or accelerate the transformation and modernisation of economic activities in clusters. There are also important synergies and complementarities between smart specialisation and cluster policy (e.g. promotion of cross-sectoral collaboration and entrepreneurial processes and place-based interactions[4] between actors and institutions) which strengthen the argument for governments to align national policy goals and instruments with regional and cluster-based initiatives.

Vertical and horizontal policies for smart specialisation

At the operational level, smart specialisation mainly refers to vertical policies at regional level. These are "targeted" policies towards supply or the demand side of the innovation activities from idea generation to market uptake. However, the concept seems to rely on the existence of some pre-conditions and capacities that are not always present in every region (e.g. entrepreneurial or absorptive capacity). To assume that these pre-conditions or capacities always exist may lead to government failures and unsatisfactory results in the "discovery process". The place-based approach of smart specialisation seem to suggest that when looking 'inside' the region the 'bottlenecks' that impede the well-functioning of the system are also identified and removed. Experience illustrated by the country case-studies in the TIP project show that in some regions horizontal and general framework policies are a necessary first step. Other regions reveal difficulties in strategic capacity building. These regional differences cannot be ignored and they need to be addressed in order to work out the smart specialisation concept (McCann P. and Ortega-Arguiles R., 2011).

Summary

The idea or concept of "smart specialisation" is based on long standing economic theories and empirical evidence and mobilises well tested policy instruments. As a regional and place-based growth policy framework it aims to improve the allocation of public investment in R&D and innovation related investments, in order to stimulate competitiveness, productivity and economic growth through entrepreneurial activities. Smart specialisation "strategies" can be viewed as a mix of modern industrial policy with innovation policies that emphasise a bottom-up approach (the entrepreneurial discovery), transparency (e.g. monitoring and evaluation) and flexibility (e.g. abandon failure programmes). But the emergence of this policy approach is by no means independent from the present economic and political context of disruptive change at the global level.

Smart specialisation strategies aim to favour experimentation in existing and new areas of activities, and adjust policies according to lessons learnt from these experiments. Smart specialisation requires effective and active co-ordination of policy interventions (e.g. policy mix and alignment of policy instruments, such as cluster policies) to enable strategic co-ordination. It also requires longer term visions on the part of policy makers but also various stakeholders, including business. At the same time, they reflect the urgency of making tough choices in times of difficult transitions under severe budgetary constraints. An adequate governance of smart specialisation can potentially ensure important efficiency gains on a systems level.

SMART SPECIALISATION IN THE CURRENT ECONOMIC CONTEXT AND POLICY ENVIRONMENT

The current economic crisis and more recently the euro debt crisis, has increased pressure on OECD governments to tackle long-standing structural problems in their economies. Smart specialisation, both as an economic concept and a policy framework provides a novel avenue to pursue the dual objectives of fiscal constraint and investment in longer-term growth potential in a context of rapid technological change and globalisation. General purpose technologies play an essential role in strengthening existing specialisations and revealing new economic opportunities in high-tech sectors, but also in traditional industries.

Although in many ways, the European Union is a laboratory for the elaboration of smart specialisation strategies, the interest in smart specialisation in OECD countries from Australia to Korea but also in the United States where variants of smart specialisation are visible in “new industry policies” or new “manufacturing strategies” as in the United Kingdom coincides with two underlying trends. The first concerns the current global economic context. OECD countries face difficult policy choices due to weak economic situation characterised by low economic demand, falling tax revenue, fiscal pressures related to the financing of health and pension systems and shrinking public budgets. This creates a difficult balancing act for policy makers, who have to reduce budget deficits and the national debt without fanning unemployment or causing long term damage to innovation capacity and the long-term growth potential.

In most OECD countries, the response to the crisis and to the slowdown in productivity growth has focused on a combination of structural reform policies - labour reform, competition policy, tax policy, etc. and efforts to preserve investments in knowledge based assets such as education and innovation especially in areas from where new drivers of growth may arise such as in green technologies and health.

Preserving the margin for public investment in knowledge-based capital so that it contributes to productivity growth will be increasingly important not only in the medium term but also in the longer term in light of challenges such as demographic change and competition from emerging economies.

The second trend which has created a fertile ground for smart specialisation, is the weakening of the national innovation systems as the unit of analysis for policy making in the face of regional innovation systems and the rise of global innovation networks. The economics of R&D location (indivisibility, strong spatial clustering of innovation activities) makes regional responses to R&D globalisation naturally appropriate. Indeed there has been a trend over the past decades to devolve competences for innovation policies to regions. Meanwhile the rise of open innovation and global value chains reminds us that internationalised firms operate outside the scope of economic conditions determined directly by national policies, even if national policies such as attractiveness policies can influence the investment and innovation strategies of global firms.

Economic and policy rationales for smart specialisation

The main justification behind policy attempts to affect specialisation is the presence of externalities or market failures preventing an efficient allocation of resources. Here, public intervention is justified based on: *1) Information externalities:* both the government and the industry have imperfect information on their own. Governments should ensure mechanisms through which they exchange information with entrepreneurs in order to learn about costs and opportunities and engage in strategic coordination (Foray, 2012; Hausmann and Rodrick 2003) and; *2) Co-ordination externalities:* private activity and 'discovery' opportunities may be restricted due to the high fixed costs and large-scale investments required by some projects, and in particular by the spillovers that are specific to knowledge driven investments. Policy intervention is required to facilitate the coordination of investments and decisions of different entrepreneurs.

A second set of rationales for smart specialisation concern: *1)* incentive problems that lead to underinvestment in the "discovery process"; *2)* The discovery of pertinent specialisation domains may have a high social value (development of the region's economy), but the entrepreneur who makes this initial discovery will only be able to capture a very limited part of this social value because other entrepreneurs will swiftly move into the identified domain ("first-mover disadvantage"); *3)* Entrepreneurial individuals that are well-placed to explore and identify new activities often will not have sufficient external connections to marketing and financing sources, reducing their incentives to enter in the first place, finally; *4)* the quality of specialised infrastructures is initially a given for the search and later an objective of support policy.

Table 1 outlines some of the failures and policy instruments that smart specialisation aims to address through both existing and new policy instruments. Incentives and policies to cope with information externalities as well as the support to technologies having scale or agglomeration effects are not unfamiliar to most policymakers. However, the coordination of investment decisions of different entrepreneurs and the coordination among many economic agents throughout the value chain are daunting tasks for policy makers.

Table 1.1. Rationales for smart specialisation

		Policy intervention	**Examples of existing and new policies/initiatives**
Information externalities	Low 'self-discovery' activity.	Incentives to reward entrepreneurs who discover new domains.	Prizes for inventions and discoveries, fiscal incentives, IPRs
	Low information exchange flows.	Incentives to involve non-traditional actors.	Incentives for public sector innovation (e.g. procurement)
	Lack of *intra*- and *inter*-regional interactions that restrict the knowledge spillovers.	Creation of platforms and mechanisms to facilitate –*intra* and –*inter* regional interactions.	Public web consultations Regional workshops
		Public policies can assist further this process by providing key infrastructures (e.g. information about emerging technological and commercial opportunities and constraints, product and process safety standards for domestic and export markets, and external sources of finance)	Innovation Vouchers Internationalisation support services

Coordination externalities	Low 'self-discovery' activity due to the high fixed costs and large-scale investments required by some projects. Prevention of emerging trends for regional economic growth.	Coordination of investments and decisions of different entrepreneurs. Coordination among many economic agents throughout the value chain suppliers, producers, users, specialised services, banks, basic research and training institutions. Support to technologies which have scale or agglomeration economies.	Cluster policies Technology banks Public-private partnerships Innovation-oriented procurement Sectoral platforms SME support organisations Demonstration projects, technology extension services

Source: OECD based on Rodrik

Smart specialisation: Beyond framework conditions

Framework conditions are essential for establishing a successful link between innovation and growth (Hansen and Birkinshaw, 2007; Asheim, 2009; Navarro M. et al., 2012). Thus, horizontal and targeted policies to improve those drivers which are particularly crucial for the success of smart specialisation are also important (e.g. increasing entrepreneurial capacity, technology absorption, international connectivity, domestic and local spillovers and creative capacity) (Veugelers R. and Morak M. 2009).

But another rationale for government action concerns not only market failure but also opportunities and goals of a society (e.g. meeting social and global challenges like ageing and climate change). Indeed, governments do not only intervene to correct market or systemic failure but they also intervene with specific goals especially in markets for goods that are public or semi-public such as national security, health and the environment. Furthermore, the government is not only there to moderate framework conditions, it has an important role in own right by creating markets (low carbon) and as a procurer of government goods and services (e.g. infrastructure, health services). (See box 3).

Box 1.3. Tackling societal challenges through smart specialisation

The main catalyst of the smart specialisation strategy in the UK automotive sector as way to transition towards a lower carbon economy was the environmental challenge of reducing CO2 emissions amidst an economic downturn. The main objective of the smart specialisation strategy is to secure the environmental benefits while regenerating competitive advantage, mainly by: *1)* Continuing to reduce C02 emissions (which have already fallen 20.3% over the last 10 years) to comply with environmental protection and safety legislation. The UK has adopted a legally binding target to reduce emissions in the Climate Change 2006, by at least 26% by 2020 and 80% by 2050; *2)* Aligning the technology, product and business performance to deliver customer value in a global industry which is subject to relentless cost-cutting pressures, in particular for the auto manufacturing industry.

The case study of Estonia shows that, due to its size, Estonia cannot effectively address all societal challenges alone, mostly due to the lack of critical mass and economies of scale. However, many of the large societal challenges are universal and are therefore well-suited to be addressed jointly, for example, between the partners of European Research Area and with the support of European policies and measures (e.g. through the Joint Programming Initiatives). This is acknowledged as a clear argument for a continued strong Estonian cooperation and contribution within the European Research Area. This also means utilising the synergies and opportunities opening up within the Baltic Sea Region and Nordic countries.

Source: OECD-TIP Case studies on Smart Specialisation

Smart specialisation: a pro-active framework for meeting the challenges arising from globalisation

Insofar as smart specialisation is about *ex ante* industrial and innovation strategies, it may offer a pro-active framework for governments to anticipate the possible redistributional effects of policy or inactions in an increasingly globalised economy. Over the past two decades, globalisation has increased specialisation by creating opportunities for outsourcing and the development of global value chains. It is a fact that this has led to a shift away from low-skilled employment in OECD countries to high skill labour and from manufacturing activities towards service oriented activities. Some OECD countries have reduced specialisation in sectors such as steel and shipbuilding and increased specialisation in fast growing and high value added areas such information technology services.

While most government response to the *ex-post* distributional effects of globalisation-driven specialisation focus on social policies such as unemployment and increased worker (re-)training, smart specialisation arguably offers an opportunity to foster a dynamic economic process that accelerates structural change and as such attenuates the negative effects of technological change and globalisation on regions, employment and older industries by creating new avenues for economic renewal and growth.

Box 1.4. Specialisation and comparative advantage

Classical economic theory tells us that regions and countries will specialise in certain economic activities according to their factor endowments (land, capital, human resources). Trade theory as elaborated by 19th century economist David Ricardo and expanded in the 20th century by Hekscher and Ohlin also tells us that countries tend to specialise in the production of goods where they have a comparative advantage. Recent economic theories touching on specialisation and trade (e.g new trade theory) tell us that other factors play a role in specialisation, often connected with economies of scale and locational externalities. Indeed, the factors that lead to comparative advantage are dynamic and change over time (e.g. human capital) (e.g. OECD, 2011; Redding, 2002). World prices of natural resources (e.g. energy) and input factors as well as technology or the discovery of new factor endowments can change comparative advantages.

Trade and technological developments are increasingly allowing firms to fragment their production in the global value chain. Recent empirical analyses of trade patterns show that countries tend to specialise in specific ‘business functions’ or ‘activities’ along the supply chain (e.g. design, R&D, procurement, operations, marketing and customer services) rather than specific industries (OECD, 2012). This supports why specialisation is no longer relevant in industries but in specific functions or activities in the value chain (e.g. assembly operations for China or business services for India).

While specialisation is often viewed in terms of macroeconomic outcomes, it is important to recall that there is a microeconomic level as well. Depending on their own “micro” factor endowments firms, especially MNEs, will exploit differently the same set of national or regional comparative advantages.

Among the conditions that affect factor endowments, specialisation and comparative advantage are the following:

Institutions. The quality of institutions such as government institutions (e.g. rule of law, competition, security), social institutions (labour-employer relations) also affect factor endowments.

Framework policies. Broad policies such as investment in education and infrastructure, social policies and regulations in labour and product markets can play a role in shaping specialisation patterns by affecting comparative advantages, even when this is not their primary goal (Lin, 2011). This has implications for framework policies that can attract or retain firms, especially MNEs, that old the complementary assets necessary for specialise in activities characterised by increasing returns on knowledge investment (e.g. automobile suppliers).

Technological attributes. Differences in technologies across regions/countries also shape specialisation patterns.

Demand factors. It has been suggested that an expansion of an economy’ scientific and technological capacity will not endow it the needed productive dynamism unless there is an adequate demand for innovation by the business sector (Rodrik D., 2004). Furthermore, demand factors such as the level of human capital and income per capita of a country’s trading partner create specific patterns of taste and, therefore, affect demand of goods (Linder, 1961).

Economies of scale and product life cycles. Specialisation can also create or help to take advantage of economies of scale. Product life cycles also affect specialisation (i.e. from novel to mature).

Market dynamics. The extent to which regions and countries are less specialised also reflects the degree of market integration. Higher levels of internal market integration, as opposed to incomplete/fragmented markets, lead to greater scale advantages. Imperfect competition, product market and labour market conditions can influence the degree of market integration.

Industrial policies (e.g. taxes and subsidies) can also play a role in shaping the production structure, for good or bad. Ill-designed industrial policies can distort relative prices and lead countries to specialise in activities in which they have no comparative advantage and, thus, are less likely to raise growth.

It is important to recall that in a global economy, changes in the factor endowments and in the specialisation patterns for trading partners will also have an impact on own-country specialisation. Policy changes in countries' trading partners can have implications for domestic specialisation to the extent that they influence the structure of foreign endowments (e.g. the quality of institutions) and, in turn, affect countries' relative comparative advantages. Moreover, changes in policy settings in countries with more rapidly changing institutions (e.g. emerging economies) may have disproportionally larger effects on relative factor demands and relative prices across countries than changes elsewhere.

Source : OECD (2012)

The contribution of key enabling technologies (KET) to smart specialisation

Modern core technologies, referred to as "key technologies" (KET) such as nanotechnology, micro and nanoelectronics, advanced materials, photonics, industrial biotechnology and advanced manufacturing systems as well as "general purpose technologies" such as ICT and biotechnology can address particular problems of quality and productivity.[5] Smart specialisation suggests that not all regions need to possess leadership in these technologies to benefit (e.g. regions can purchase or access such platforms from the market in neighbouring regions or abroad). Thus, the key question for regions is how to focus their knowledge investments to take advantage of these technologies. While some regions are better in carrying out basic research or technological development of these technologies, others should focus on the use and application of these technologies. Catching up regions may want to focus on policy instruments that increase the absorptive capacity for these technologies such as providing consultancy services to SME to facilitate the adoption of specific technologies; knowledge transfer institutions and educational programmes. In the region of Malopolska, Poland the emergence of fast-growing companies and clusters in industries like information and communication technologies and telecommunications has been supported by the changes of the profiles of regional universities. In the case of advanced regions with a very strong knowledge base, they too need to develop the capacity to absorb outside knowledge in order to create new niches.

Given the range of applications of these technologies, technology platforms involving public and private actors but also standards settings organisation can leverage productivity in existing sectors or help reveal or identify sectors in which to concentrate resources. In Finland's Lathi region, for example, a publicly-supported "Technology bank" provides access to SMEs to a group of related technologies through a single license. Assemblies by product area or technology area generates a potential to understand latest technologies and provides potential to license patents and gets access to technologies of large multinational enterprises. In many cases, the large enterprises are interested in buying or licensing the technologies that are developed further by the SMEs.

Non-tech and low tech innovations

The smart specialisation framework recognises the role of both technological and non-technological innovation to the process of specialisation/diversification. The smart specialisation approach is relevant for R&D intensive activities as well as for traditional sectors where innovation is often more incremental and non-technological.

Smart specialisation, regional economic development and place-based[6] growth

That smart specialisation has an important regional dimension is obvious. Regions are increasingly recognised as a relevant level of innovation policies given the weight of agglomeration economies (e.g. the benefits that firms obtain when locating near each other; the more related the firms that are clustered together, the lower the cost of production, the greater the learning and network effects).

The OECD carried out a survey among regions[7] in order to investigate the governance of their innovation policy. The survey results show that the prioritisation of public investments in R&D and innovation is more intense at regional than at national level. This is especially the case in the EU regions and has to do with the globalisation and the ensuing pressures for greater integration of research and innovation policies. In many EU countries, policies related to knowledge investments – from education, research and innovation and industrial/sectoral policies are spread across many fields of intervention with a lack of critical mass; the weak international orientation of most strategies; and the limited knowledge about impacts of the strategies. The fragmentation of the European research system does not only create wasteful overlaps, and limit the possibilities in some activities to exploit economies of scale, but it also does not match the regional distribution of innovation capabilities.

The OECD categorisation of regions on the basis of innovation-related indicators shows that different regions have different levels of performance. Some OECD regions perform better than their national average (e.g. Catalonia region and Spain), nearly all of the knowledge hubs (California, Baden-Württemberg, Stockholm) belong to countries that are "Innovation Leaders“. This means that the innovation challenge will vary according not just to the regions but also the economic structure and the specialisation of key agents; firms, public research institutions and universities (OECD, 2011).

In the main, the smart specialisation approach suggests regions, especially those regions which are not leaders in any of the major science and technology domains, to investing in R&D and innovation on few key priorities.[8] The logic is: *1)* regions cannot do everything in science, technology and innovation and; *2)* they need to promote what should make their knowledge base unique and superior to others. The key challenge for regions is how to identify those activities or domains where new R&D and innovation projects will create future domestic capability and interregional comparative advantage (Foray D. et al. 2011). Here, recent empirical evidence suggests that “related variety” - which refers to economic diversification offered by combining localised know-how and assets into new innovations that are related to existing areas of strength - leads to the best economic returns (Frenken et al. 2007; Boshma et al. 2012).

Table 1.2. Patterns of structural change: Towards a Smart specialisation strategy

Mix of elements from different strategies	**Objectives** *(For what)*	**Strategic choice** *(What)*	**Elaboration process** *(How and by whom)*	**Results of the 'self-discovery' process** New activities emerging from:
Enterprise	Maximise value and economic returns.	Differentiation of the product, resources and capacities within the enterprise.	Different processes, but strong commitment of all stakeholders.	The existing industrial commons (transition) The application of a GPT in an existing sector (modernisation)
Territorial	Improve the social being (linking economic, social and environmental objectives)	Differentiation of the activities/assets/services offered by the region (*e.g.* to attract firms or foreign investments)	Multiply participation since none of the participants have authority to commit others.	New synergies between existing economic activities with new or emerging activities (*e.g.* new line of productive activity) (diversification) An entirely new domain (radical formation)

Source: OECD (2012) based on Foray (2009); Navarro M. et al, 2012 and OECD TIP case-studies on smart specialisation.

From this perspective, smart specialisation strategies offer an opportunity for economic transformation of regions based on strategies that link actions to objectives in order to:

- Ensure differentiation and unique position in the market of the activities carried out in the region, based on the resources and capacities available (e.g. what is the value added of the new products, what markets).
- Ensure differentiation and unique position of the activities and conditions offered by the region (e.g. to attract firms and/or foreign investments).
- Link economic goals with societal and environmental challenges (e.g. the transition of the automotive industry to low carbon in the United Kingdom).
- Allow experimentation, creativity and rapid adjustment of the strategies to the changing conditions.
- Ensure the commitment and involvement of all stakeholders – regional, national or supranational – in the designing of the strategy and consecution of its objectives. In the Netherlands, the case of the Brainport Eindhoven Region illustrates this through a model based on a set of Triple helix (government, universities and firms) collaborative initiatives and public-private partnerships to strengthen the region's economic and innovation base.

Summary

The current economic crisis and more recently the euro debt crisis, has increased pressure on OECD governments to tackle long-standing structural problems in their economies. But restarting growth has also increased attention in countries about the need to preserve the margin for public investment in knowledge-based capital, but doing so in a "smart way" so that it contributes to productivity growth and competitiveness. Smart specialisation, both as an economic concept and a policy framework provides a novel avenue to pursue the dual objectives of fiscal constraint and investment in longer-term growth potential in a context of rapid technological change and globalisation. The rationale for smart specialisation goes beyond traditional market failure arguments for framework conditions and highlights the role of: *i)* regional governments; *ii)* knowledge-based institutions; and *iii)* and entrepreneurs, in shaping specialisation and competitiveness in a holistic place-based approach. General purpose technologies play a particularly essential role in strengthening existing specialisations and revealing new economic opportunities in high tech sectors but also in traditional industries.

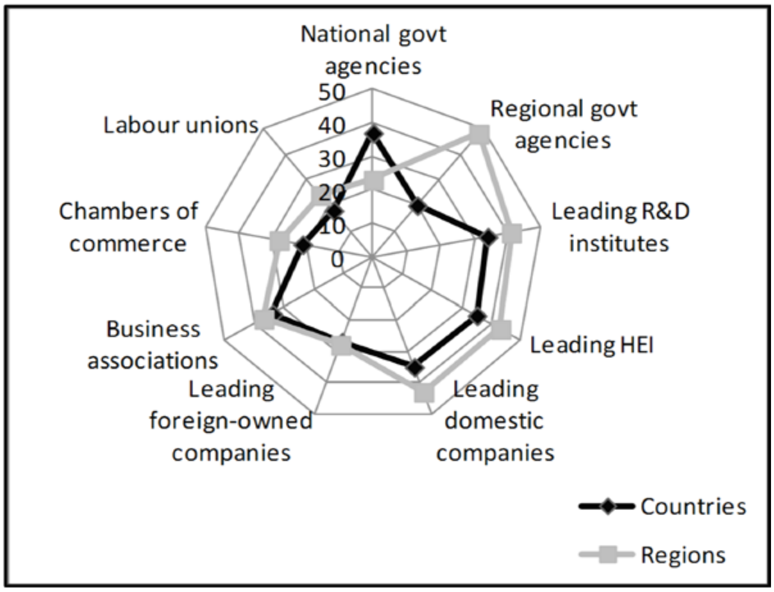
DEVELOPMENT OF SPECIALISATION STRATEGIES: THE ROLE OF REGIONAL PROFILNG AND INDICATORS

Designing a specialisation strategy at the regional level requires an intelligent use of data in order to diagnose apparent strengths, weaknesses, complementarities and mismatches in terms of scientific, technological, innovative and economic capabilities. However, most of the existing indicators focus mainly on the past and the present, being not able to grasp emerging opportunities for the future. The use of foresights exercises and diagnostic tools can be particularly useful to identify these emerging ‘activities’ and new synergies and complementarities. Developing a set of quantitative and qualitative indicators would contribute not only in situating the regions and their respectful strategies in a broader context but also enhance communication between relevant actors on the basis of a comprehensive language.

Designing smart specialisation strategies

The process of designing a specialisation strategy is normally initiated by lead actors or institutions that are strongly committed and well positioned to mobilise other stakeholders and resources and to set the strategic framework for further actions. These lead actors may arise, for example, from companies, research institutions, national or regional authorities. The role and diversity of these lead actors and institutions in setting the priorities and designing of the strategy permits a more diverse, interactive process, comparing to the purely vertical decision by government agents, oftentimes at the expense of a market-driven allocation of resources (See Figure 1.1). As stated previously the smart specialisation approach calls for an ‘entrepreneurial-driven’ allocation of resources.

Figure 1.1. Degree of involvement of types of actors in the selection of policy priorities



Note: Countries: 10 respondents. Regions: 10 respondents
Source: OECD-TIP enquiry in governance for smart specialisation

Once the process of ‘discovery’ has been initiated, the immediate challenge is to ensure mechanisms or structures for these new ‘entrepreneurial bottom-up initiatives’ to emerge and prove they can mobilise the relevant stakeholders that have the potential to provide value added. These structures are necessary to ensure the ‘open invitation’ flows between all stakeholders and empowering as well as accelerating the learning process. Thus, the entrepreneurs discover emerging activities of future specialisation and other stakeholders contribute to identify existing capabilities (e.g. research capabilities) but also barriers (e.g. regulatory constrains or institutional problems) to allow these activities to flourish further (See box 1.5).

Box 1.5. The importance of strong lead actors and management structures

In Estonia, ICT companies have a very strong association of enterprises – Estonian Association of Information Technology and Telecommunications, which plays a leading role in cluster and education development. Estonian ICT Cluster, supported by the national cluster programme, aim to offer highly functional, reliable services and integrated solutions to various industrial sectors and countries based on the complementary experiences existing in the Estonian ICT sector as a whole. This includes the creation of several world class e- and m-services for both public and private sector (the ID-card applications, m-parking solutions, etc).

In Flanders (Belgium) in the case of FISCH (Sustainable Chemistry) the employers federation Essenscia Flanders developed a business plan for the FISCH initiative, involved the stakeholders from the wide business community and built the ‘light structure’ that was needed to raise funding from the Flemish government. With this ‘light structure’ now in place, there is a cluster-type management to organise further strategic activities. Strategic intelligence and methodologies for road mapping play an important role in streamlining the entrepreneurial process.

In Andalusia (Spain), the metal-mechanic companies turned to aeronautics, after the decline of the shipbuilding industry during the 80s, as a potential market opportunity. Utilising their existing know-how and competences these metal-mechanic companies engaged in intensive dialogue with the regional government, who helped to empower these companies (*e.g.* with soft loans for new machinery). The aerospace sector experienced a sustainable growth over two decades stemming from a regional strategy based on risk sharing funding of original equipment manufacturer (OEM) programs and the commitment to a policy of “fine tuning to the sector’s needs”.

In Australia and Finland, on the contrary, the national governments have taken the lead and by organising regional panels, the national government gets engaged in intensive consultation with regional stakeholders, in order to detect emerging opportunities but also bottlenecks and threats to push these opportunities further.

Source : OECD -TIP case-studies on smart specialisation

The universities dealing with economics, public policy and administration, and specific policy areas (e.g. industry, health, agriculture, environment and culture) can play a crucial role during the process of designing the innovation strategies[9] (EC-IPTS (2011).

As companies are continuously redefining their strategies, regional governments and key stakeholders should be ready to adjust their responses rapidly to the changing conditions (e.g. strengthening the collaboration between Universities and Business in curricula design and curricula deliver may ensure that graduates have the right skills and transversal competences required by the market (EC-IPTS (2011)). For example, in Estonia, the rapid growth of RDI requires a higher number of skilled human resources than currently available. Industry representatives in Estonia have highlighted that the lack of educated and skilled workers as an important challenge for future growth.

The necessary mechanisms or structures for these new ‘entrepreneurial bottom-up initiatives’ should also serve to phase out the support/activities with no potential to restructure the economic fabric. Some of the institutional adjustments required to deal with the emerging place-based activities are illustrated by the experience of the regions and countries taking part in the OECD project (see box 6).

Box 1.6. Detecting changing conditions and adjusting policy actions

Changing the role of regional universities: In the region of Malopolska, the emergence of fast-growing companies and clusters in industries like information and communication technologies, telecommunications and pharmaceuticals has been supported by the changes of the profiles of regional universities. Regional universities are also engaged in many initiatives aimed at addressing the main challenges in traditional areas of regional specialisation (*e.g.* mining and clean coal technologies).

Abandonment of failure programmes: In Lower Austria, two cluster initiatives which initially enjoyed public support were discontinued due to the weak support received by companies active in their respective sectors. Namely, the *Automotive Cluster Vienna Region* (ACVR) and the *Wellbeing Cluster of Lower Austria*.

Intensive stakeholders' consultation: In Australia, future bottlenecks/threats of the Australian grains industry are detected by direct consultations among grain growers, the Australian Government, research partners and other stakeholders. Based on this, the Grains Research and Development Corporation (GRDC) identifies the most likely drivers of change in the GRDC's immediate and broader business environments over the next five years. They include grain market characteristics, environmental issues, government policy and regulatory requirements, R&D and delivery, customer expectations and social issues.

Source: OECD -TIP case-studies on smart specialisation and

Innovation systems are increasingly borderless and regional economies are increasingly interconnected. Governments may want to take the inter-regional and international dimension of the emerging activities into account in their strategies (e.g. to increase regional competitiveness, to detect business opportunities and to capitalise on synergies and complementarities with other regions). Here, international organisations could serve as platforms to facilitate inter-regional and international interactions across sectors (e.g. the International Association of Science Parks and Innovation Areas).[10]

Likewise, governments may also want to consider and assess how their policies can have an impact on firms and the location of activities and adjust them accordingly (*e.g.* simplification of policies and integration of markets). Nonetheless, the results of the governance survey show that regions and countries define their strategies mostly from an internal perspective and that the cross-border dimension of strategies in still in its infancy (See Box 1.7).

Box 1.7. Openness to other regions and internationalisation of strategies

In South Moravia, existing bottom up activities imply cross-border interactions. Thus, a potential for geographical extension of the South Moravian innovation strategy is acknowledged. However, existing administrative borders and political mandate pose a barrier. In the Moravian innovation eco-system, in terms of manufacturing specialisation, there are several common strategic fields (e.g. machine tools, precise machining, mechatronic modules and components for various high-tech industries and precise measurement technologies) where increasing intensity of R&D collaboration across regional borders could bring new opportunities.

In Andalusia, its peripheral position raises both opportunities and challenges for cross-border collaboration. Its close position to the Mediterranean area, as the European gate to Africa, is acknowledged as a unique position to explore cross-border activities. Nonetheless, the region acknowledges the need to link Andalusian capacities to other cutting-edge scientific and productive regions, in order to facilitate Andalusian firms and knowledge centres to be part of competitive international value chains.

In Australia, the exposure of the grains industry to international competition ensures that innovation driven productivity growth is a constant priority. Recognising that the Australian grains ecosystem is connected to global economies lead the Grains Research and Development Corporation to design its priorities to be compatible with other regional, national and international drivers. For example, in July 2012 the Australian Government released its Green Paper for a National Food Plan to foster a sustainable, globally competitive, resilient food supply that supports access to nutritious and affordable food.

In Lower Austria, the development of the innovation system included a specific linkage to available competences in the Vienna and Centrope region such has the Vienna's research infrastructure. The case refers to spill-over effects, as the Viennese research and innovation infrastructure has positive effects on the structure of Lower Austria. Although cross-border activities and networks exists in the region, the geographical position of Lower Austria, very close to Czech, Slovakian and Hungarian regions, is acknowledged as a potential source for new cross-borders activities.

Source : OECD TIP case-studies and enquiry in governance for smart specialisation

The mobilisation and empowerment of key stakeholders and institutions to realise their potential as leading contributors are essential elements to transform a traditional regional innovation strategies into regional ones for smart specialisation. Successful mobilisation of the resources of the universities may also have a strong positive effect on the achievement of comprehensive regional strategies (EC-IPTS (2011)). The factors needed to ensure an efficient contribution from all relevant socio-economic actors involved in the designing of the smart specialisation strategy include: *i)* the participation of the leading institutions of knowledge: universities and institutions of research, innovation and creativity complement the market know-how of business entrepreneurs with sound expertise for the skills, scientific and technology frontiers that exist in a country or region; *ii)* the participation of highly skilled workers in the process, given the increasingly cross-sectoral, cross-technology and cross-border dimension of activities, in order to easily process the knowledge required to identify complementarities and synergies (e.g. related diversification); *iii)* the need to build trust and reciprocity among all socio-economic actors involved; *iv)* the need to use a common language between all actors to achieve common objectives, goals and commitment; *v)* the need to increase transparency on how stakeholders are selected, involved and, especially, what role (empowerment) they are provided during the process (See Box 1.8).

Box 1.8. Empowerment of stakeholders in the designing of the smart specialisation strategies

In the context of the Brainport Eindhoven Region in the Netherlands, the innovation system is to an important extent 'business-driven', powered by entrepreneurial leadership and strong collaboration between industry, knowledge institutes and government in the triple helix[11] and ample participative involvement of civic society. The tradition of entrepreneurial leadership and co-operation goes back a long time in history. Entrepreneurs such as the brothers Philips (Royal Philips, established 1891), Van Doorne (DAF, established 1928), Van Thiel (metal-/steel industry), and Father Van den Elsen (co-operative banking, nowadays Rabobank) laid the foundations for a strong industrial base. Relatively new OEMs such as AMSL, Océ, NXP and FEI are a continuation of this tradition. Many of today's initiatives and projects stem from and are led by private business. The R&D and innovation governance model explored by the Brainport Eindhoven Region has unique features, characterized by public-private partnerships (e.g. Holst Centre), strong involvement of knowledge institutes in close proximity, open innovation (e.g. the former Philips, nowadays High Tech Campus Eindhoven), multidisciplinary and cross-overs between technology domains, low barriers and high trust. The role of government in the triple helix is relatively modest, yet important, as a funder of public R&D expenditure, public infrastructure and as a stimulator and co-ordinator.

In Turkey, on the contrary, relevant stakeholders of the automotive sector (Companies of the cluster of the automotive sector are acknowledged to enjoy a strong "critical mass") are invited only with advisory capacity to the STI policy-making meetings with the Supreme Council for Science and Technology (SCST). Ad hoc committees are organised, 'as necessary', to allow stakeholders to identify specific problems and generate policy recommendations that feed-back into the policy-making process. After the meetings, the SCST 'assigns' tasks to stakeholders for the implementation of the adopted decrees.

In Austria, smart specialisation and the RIS3 KEY are used by the federal government, together with public performance-contracts, to mobilise universities and research institutions to deal with their regional habitat in a strategic way ("Standortpolitik"). The RIS3 KEY also pursues that lead institutions realise their potential role in shaping their regional profile. For example, the Upper Austria's innovation and specialisation strategy is based on a continuing process of multi-level governance with extensive participative elements. Thematically focused working groups were established, counting more than 250 stakeholders. Agents from the business side, academics, and special interest groups and from the social partners, participated in the design and implementation of the "Innovative Upper Austria 2010" program. The top-down component assures a strategic fit with complementary regional, national and European policy goals and measures. The chosen approach enables a systematic and quick response to experiences during the process and the implementation phase. A challenge in such participative processes, however, is the division of competencies during the development of the strategy and the final control and monitoring of the implementation.

Source : OECD TIP case-studies on smart specialisation and the project results

Profiling the region

Together with strong leadership and stakeholder's involvement, another important element is the use of quantitative and qualitative data to situate the region, country or emerging 'activities' in a larger picture. The key question is what data and tools are needed – and available – to support policy makers to assess the potential of emerging activities and to detect bottlenecks for future specialisation and development. The analyses of the case-studies show that most countries and regions use different methodologies such as science and technology indicators analyses, regional sectoral employment distribution, export indicators, road mapping, SWOT analyses and foresight approaches.

Thus, data and indicators are necessary to track progress, assess structural transformations and compare strategies. Indicators to measure specialisation in science, technology and employment may help policy-makers in diagnosing of strengths, weaknesses, fits and misfits in terms of scientific, technological, innovative and economic capabilities. However, these indicators are mostly geared towards past and present specialisations and may not capture the increasingly cross-sector and cross-technology emerging 'activities' since these are not easily captured in traditional lists of research disciplines (Box 9).

Box 1.9. Indicators of science, technology and economic specialisation for place-based growth

Longitudinal analyses of patterns in scientific, technological and economic specialisation – and potential lags or interdependencies between the different components – can provide policy makers with background information to assess the sustainability of traditionally strong sectors or, to consider providing public support to those areas where research capacity is strong but economically weak. Likewise, comparison of technological and economic specialisations may show economically strong domains where technological activity is relatively weak or vice-versa. In such cases, policy makers may want to consider whether stimulation for technological advancements or international technological collaborations would contribute to the sustainability of these industries.

Relative indicators, such as the Activity Index (AI) for scientific activities, the Revealed Technological Advantage (RTA), and the Revealed Comparative Advantage (RCA) for economic activities, are used to avoid biases and to compare countries and countries on an "equal basis". Relative specialisation indices integrate a comparison of profiles of a focal country/region to profiles of reference countries/regions. They can hence be used to answer questions like "Where does a country (or region) stand in various science/technology/economic domains, compared to other countries (or regions)?"

Relative indices can be computed for scientific and economic specialisations. The former are often based on publication numbers per science domain, while the latter can use a variety of data types, including number of employees, number of newly established enterprises, Gross Domestic Product, and export data per economic sector. For countries, sufficiently detailed, internationally comparable economic data is available from OECD (www.oecd-ilibrary.org/industry). Unfortunately, on a regional level, it is difficult to find sufficiently detailed, internationally comparable economic data. The most appropriate data appear to be OECD's regional labour market statistics.

By comparing specialisation indicators over time, changes in scientific, technological or economic specialisations can be analysed. Interesting insights can also result from studying relations between scientific, technological and economic specialisations, which can be mapped using conversion tables (see for example Callaert et al., 2011). Examples are two-dimensional mappings of technological and economic specialisation indicators, or of scientific and economic specialisations that generate insights into the past, present and future endeavours. For example, it is questionable whether a historically important economic specialisation can be expected to last if scientific and technological strengths in underlying areas are absent. Similarly, strong scientific or technological positions that do not translate into economic performance raise policy questions regarding knowledge transfer.

Alongside those relative indicators, which are important from a benchmarking and from an evolutionary perspective, it is also relevant to study the absolute positions of countries and regions on the indicators developed and deployed (see chapter 3 of this report). Those absolute positions are important since they signal a presence or lack of critical mass in the fields subject to prospective specialisations studies. A nation or a region can indeed at first sight have a strong relative position in a certain area, though upon further inspection (and given the mathematical nature of the relative indicators) it may still lack a distinctive critical mass in that area.

Nonetheless, indicators for science, technology and economic specialisation also have some inherent limitations: *i)* they are mostly geared towards past and present specialisations and may not capture 'emerging' activities that are not easily captured in traditional lists of research disciplines (*e.g.* 'healthy ageing'); *ii)* they require high technical skills in terms of calculation and careful interpretation; *iii)* they are only informative, meant to feed in discussions among stakeholders and cannot be used directly for taking decisions, notably because they can hardly identify emerging activities.

Source : ECOOM - Centre for Research & Development Monitoring at Leuven University

In order to help policy makers to have a broader picture on national or regional specialisations, additional – and sophisticated – indicators could be developed to map the interactions between science and technology, detect emerging scientific and technological domains and mapping inter-regional collaboration (See Box 1.10).

Box 1.10. Advanced specialisation indicators

References contained in each patent application to previous relevant patents can provide information on the interrelatedness of various technological domains.

References contained in each patent application to research papers reporting results on which the invention is based, can be used to map the science-technology nexus, which can point to interesting opportunities for technology development and to gaps in the regional or national scientific profile.

Sophisticated techniques combining citation-linked and text-based approaches allow for monitoring the evolution of scientific and technological domains and for the detection of new, emerging topics within existing fields.

International and interregional collaborations in science and technology development can be mapped by studying co-authorship or co-inventorship patterns between countries, regions and their respective institutions as articulated in the Triple Helix concept.

In addition to publications, patents and economic performance indicators, other data are relevant for assessing a country's or a region's STIE potential. Some examples include expenditures on innovation and research and development in specific sectors, the availability of human capital for certain scientific, technological and economic areas, the presence of IT-infrastructure in specific sectors, etc. On a national level, some sector specific datasets are available. Unfortunately, it is very difficult to find regional data that are sufficiently detailed in terms of relevant underlying fields, and that are comparable across different regions.

STIE= Science, Technology, Innovation, Economy

Source : ECOOM - Centre for Research & Development Monitoring at Leuven University

Additional limitations to data analyses arise when considering that regional internationally comparable data – especially on economic specialisation – are underdeveloped. A number of indicators for innovation, research and development commitments, complementary investments in related industries, early stage market transactions as well as for inter-regional and international collaboration deserve more attention in the future. For example, the ongoing OECD work on global value chains is building national indicators based on the new data available to measure trade in value-added terms: the OECD ICIO model and ORBIS firm-level data. It could be interesting to explore if regional indicators can be developed to help regions to position themselves in the 'global value chains'.

In addition to quantitative data, diagnostic tools can be particularly useful to identify these promising 'activities' – not captured by existing empirical material – but that have already reached a certain degree of local commitment in the development cycle. Here, foresight exercises have been highlighted as a powerful tool to develop a shared vision of the future among all stakeholders. Such an exercise may be a strong complement to quantitative and qualitative analyses looking at the past and present of a region, by combining: *i) Information:* to better understand the complex interactions in which emerging activities evolve; *ii) Intelligence:* through scanning to explore novel ideas, unexpected issues and shocks, as well as persistent problems or trends; *iii) Imagination* by integrating foresight, creativity and design for scientifically possible, technologically feasible and socially desirable futures; *iv) Interaction* with the systematic involvement of stakeholders in an inclusive process with long-term perspective for the analysis of different perspectives and their social relations in the system; and finally, and *v)* an effective *Implementation* for a successful transformation programme (Saritas, O. 2011).

Some case-studies show how lead actors or institutions are developing their own methodological tools to analyse existing strengths, collecting the knowledge embedded in the regions (and across regions) and to conduct forward looking analyses to define further actions (See Box 1.11).

Box 1.11. New methodological tools for mobilising and profiling regions

The RIS3 KEY[12] for self-assessment: The RIS3 KEY is a brief and easily comprehensible tool for regions to introduce the idea of smart specialisation and start their RIS3 process. It can help to stimulate communication among key players and permits a quick first assessment of their status and potential that is needed to prepare a SWOT analysis as described in the European Commission's RIS3 GUIDE. It provides four sets of complementary questions that address relevant dimensions of a region ready and willing to start or improve their RIS3 development process. The RIS3 KEY can be used to assess the following: the enterprise sector, the science / knowledge & creative sector, the government sector and the regional innovation system as a whole – covering interactions between all three sectors. The RIS3 self-assessment KEY may help regions to prepare further steps on the way to smart specialisation by:

- Identifying existing strengths and potentials for future development efforts,
- Spotting remaining gaps and bottlenecks in the regional innovation system,
- Mobilizing the relevant institutions and actors to be involved in the RIS3 development process, and by
- Defining possible starting points for your RIS3 development process.

Mapping exercise: In the case of NanoforHealth, the strategic research centre IMEC in Flanders took a lead role in defining the potentially new domain by combining its own expertise with complementary expertise in the region, develop a method to map the multidisciplinary expertise in this field, and motivate the (public and private sector) actors from this domain to take part in a mapping exercise. This preparatory activity is subsequently taken up by the existing cluster organisations in adjacent domains, which will explore the possibilities to build a similar 'light structure' and transform this loosely emerging domain into a more self-organising network.

Web consultations: The development of the information and technology communications (ICTs) has strongly facilitated the connectivity and communication within regions (and inter-regions). In Poland and the Netherlands, the prioritisation process involves citizens through web consultations.

Cross-regional governance structure: The innovation strategy between Brandenburg and Berlin (innoBB) has developed a specific cross-regional governance structure to develop joint strategies activities and to compare common fields of excellence in both regions. Over the years of this process the number of prioritised fields was reduced.

Innovation database: In Finland, the Technical Research Centre (VTT) has made a path-breaking research on the sources, nature and development of Finnish innovations. During the last 15 years the so-called SFINNO project has identified nearly 5 000 innovations and collected data on them. This database makes it possible to make versatile studies of the renewal of the Finnish economy and innovation environment. The study represents pioneering work in the area of impact analysis in Finland. VTT updates the survey every other year by identifying innovations in economic and technical publications. This object-oriented approach is complemented by sending a questionnaire to the innovator. Based on the questionnaire, they defined typologies of different kind of innovations and linked individual innovations to actors in the Finnish innovation system. An innovation is defined here as a new product, service or method that produces economic or social benefit. The number and types of innovations in the marketplace will be followed in Lahti region and other regions utilizing the SFINNO database.

Source: OECD -TIP case-studies on smart specialisation. The RIS3 KEY for self-assessment at www.era.gv.at (Available in Czech, English, German and Spanish).

Summary

The smart specialisation process can be initiated by different lead actors or institutions such as companies, research institutions, national or regional authorities. The role and diversity of these lead actors and institutions in setting the priorities and the designing of the strategy may help to clarify that the smart specialisation approach calls for an 'entrepreneurial-driven' allocation of resources. Once the process of 'discovery' has been initiated, the immediate challenge is to ensure mechanisms or structures for these new 'entrepreneurial bottom-up initiatives' to emerge and prove that they can mobilise – through an open invitation – and empower the relevant stakeholders that have the potential to provide value added.

Data and indicators to measure specialisation in science, technology and employment may help policy-makers in diagnosing apparent strengths, weaknesses, fits and misfits in terms of scientific, technological, innovative and economic capabilities. However, they are mostly geared towards past and present specialisations and may not capture the increasingly cross-sector and cross-technology dimension of emerging ‘activities’, since they are not easily captured in traditional lists of research disciplines. To fill in these gaps, the use of foresights exercises and diagnostic tools can be particularly useful to identify these emerging ‘activities’ and new synergies and complementarities. The role of the government could be to communicate the existing tools and set the necessary mechanisms to reduce imperfect information among all stakeholders.

GOVERNANCE MECHANISMS AND POLICY TOOLS FOR SMART SPECIALISATION

Governance for smart specialisation requires strategic capacities to grasp future opportunities, mainly in order to: identify local strengths; to align policy actions and to build critical mass; to develop a vision and implement the strategy for the regions; thus the importance of strategic policy intelligence as a tool for governance of smart specialisation. This chapter presents various relevant policy instruments for smart specialisation. The major challenges for policy makers is to synchronise regional and national strategies for a better articulation of priorities and to clearly link the policy instruments to the priority setting and budgetary process.

STI governance and smart specialisation

Strategies for smart specialisation present new governance challenges for policy makers. STI governance may be defined as a set of publicly institutional arrangements that shape the ways in which public and private actors involved in socioeconomic development interact when allocating and managing resources for innovation. Institutional arrangements contributing to the co-ordination of innovation policies range from national strategies and visions, innovation agencies and ministries, policy evaluation and reviews, information channels of communication, staff exchanges and inter-agency joint programming (OECD, 2012f). Some of these new challenges can be grouped as follows:

Multi-level co-ordination

The difficulties for an efficient co-ordination of innovation-related policies across different ministries and agencies required for STI strategies in the smart specialisation process are following:

- *Multi-disciplinary dimension of emerging activities in terms of knowledge, activities and actors:* the emerging of cross-sectoral and cross-technological activities require multi-level communication and policy coordination across a higher number of different ministries and agencies (local, regional, national and supranational) and across a higher number of policy areas (*e.g.* industrial, innovation, education, energy, transport and entrepreneurship).
- *Growing STI governance at regional level*: co-ordination of STI policies is affected by a growing regionalism, in which more control over policy and resources is devolved to sub-national authorities.[13] This requires development of governance models allowing national, inter-regional and regional co-ordination.
- *New cross-border governance mechanisms*: to support and coordinate the emerging 'activities', which increasingly involve actors that go beyond administrative borders. This demands inter-regional co-operation between different authorities. It also brings new challenges to national governments where regions enjoy different degree of autonomies (See box 1.12).
- *Growing international governmental organizations and regulations shaping governance regimes:* multi-level alignment of policies could help to push emerging activities further and create the critical mass needed to play a role globally.
- *Efficient eco-system management:* the increasing multi-disciplinary, cross-sectoral and cross-border profiles of key actors involved in socioeconomic development challenge traditional innovation systems and require development of adequate conditions to build trust, effective communication and commitments.

Box 1.12. Good practice examples for multi-level co-ordination

Multi-level co-ordination: In Finland, in order to design a national strategy, a vertical link was formed between the National Innovation Strategy, the Ministry of Employment and Economy Corporate Strategy and Sectoral Strategies, the Finnish Funding Agency for Technology and Innovation Investment Strategy (Tekes) and the Regional Innovation Strategies. The Tekes 2008 strategic focus area paper “People-Economy-Environment – Choices for building the future” represented the main linkage between regional and national strategies. The paper was formulated through a broad-based process with over 5000 contributors from different sectors and regions. The paper outlines global drivers of change and current challenges of the Finnish economy and industries. In accordance, it presents eight national (lead market) themes and practices, as well as six cross-cutting competences and technologies for Finland. These choices were made to drive research, development and innovation activity to areas where Finland would have the best opportunities for growth and competitiveness globally.

Cross-border collaboration: Brandenburg and Berlin (Germany) have developed a specific cross-regional governance structure and an inter-regional innovation strategy (innoBB) to join forces between both regional administrations to leverage the policy instruments required at all levels. In Lower and Upper Austria, an attempt is being made to define specialisation areas, taking into account the cross-border dimensions, but this still calls for further development. The Dutch-Belgian corridor Eindhoven-Leuven is another case of cross-border collaboration, especially in R&D and innovation, with IMEC and Holst Centre as good practice examples. Also, the joint participation in InnoEnergy KIC (Knowledge and Innovation Community), established end 2009 by the European Institute of Innovation and Technology (EIT). The challenge ahead is to improve cross-border collaboration at the level of high-tech starters and SMEs.

Source : OECD -TIP case-studies on smart specialisation

Loosely defined ‘activities’ and technology domains

Another challenge arises from the ‘loosely defined’ emerging ‘activities’ that may span across research fields, technology domains, economic sectors, which are not easily captured by traditional classifications[14]. Among these are:

- *Lack of clearly defined set of actors:* of the emerging ‘activities’ which are less organised and have a lower critical mass than traditional activities. This is a particular challenge for policy makers when identifying and ensuring the participation of key actors (even within governments) during the ‘self-discovery’ process.

- *Lack of institutional or formal arrangements and a clear agenda:* some of these activities are still ‘homeless’ or sit in between different ministries. The horizontal fragmentations in policy-making hinder co-ordination and more efficient public intervention.

Synchronisation of strategies

One of the most crucial issues of the smart specialisation process is the need to synchronise, on one hand, the national innovation strategies with the regional strategies, and on the other hand, the different regional strategies among themselves to make them consistent with each other. The analyses of the case studies show that some regional strategies may focus on technology areas, some on industrial clusters and some on picking industries. In the synchronisation process towards formation of the smart specialisation strategy, it is important to involve participants across industries, academia, regional and national governments in order to avoid duplicities. The same kind of logic holds with the EU, national and regional strategy synchronisation procedures (See box 13).

Box 1.13. Synchronisation of national and regional strategies

In Finland, the synchronisation process of Finnish national and regional innovation strategies in year 2008 had the aim to increase the competitiveness of the Finnish economy by: *i*) building a strong knowledge base network; *ii*) renewing the economy and creating new businesses; *iii*) increasing productivity in industries and the service sector; and *iv*) enhancing wellbeing in society and improving environmental sustainability. Globalisation was outlined as the key driver of change, transforming performance and value creation logics of national and regional value networks. After this synchronisation process, the national and regional authorities concluded that critical mass should be situated in only a few multidisciplinary centers, encourageing at the same time development of several specialised centers. The importance of utilizing complementary competences in a flexible manner in order to enhance a cross-regional interaction in national collaboration was emphasized. In the Päijät-Häme (Lahti) region case, the concern was to find the cross-cutting competences and industries being able to create the most competitive value for a low level R&D activity area.. Further in the process, national and regional innovation policy goals were harmonized, and nationally selected lead market areas were translated into the regional context..

In Australia, regional priorities are the key determinant in a yearly setting of the R&D priorities for the national Grains Research and Development Corporation (GRDC). Growers participate in regional Annual General Meetings and elect panel representatives. The prioritisation process is made up by three regional panels collecting grower priorities and synthesising these at the National Panel. The regional panels are composed of grain growers, agribusiness practitioners, scientists and the GRDC's Executive Managers, with a possibility for other industry experts to participate as appropriate. The National Panel is composed of the chairs of the three regional panels, the Managing Director and the GRDC's Executive Managers.

Source : OECD -TIP case-studies on smart specialisation

These new challenges may help to explain why smart specialisation strategies are still in an early phase in most countries both from a policy development and deployment perspective.

Market conditions

Beside the governance challenges resulting from policy processes and capacities, changing market conditions require new, flexible and innovative governance mechanisms to allow governments to react, adjust or re-direct rapidly their public support to the new needs (e.g. new market requirements demanding new skills). Some of the exogenous factors restricting government's reactivity arise from:

- *Path-dependences*: the stickiness of public allocations to existing organizations, programmes or initiatives may prevent a 'quick' shift of the public support towards new activities.
- *Regulatory constraints*: long-term programmes are sometimes difficult to reshape because of regulatory conditions. The smart specialisation approach requires flexible tools, for example, to allow the abandonment of failure programmes.[15]
- *Proliferation of policy frameworks:* the growing interconnectedness of economies re-enforce the need for increased regional and international collaboration and for a coherent alignment of policy frameworks to adjust policies to business reality (e.g. simplification of policies and removal of regulatory barriers).
- *Vested interests:* Each programme benefits a particular set of actors, who may resist its suppression.

How to institutionalise smart specialisation?

The results of the governance enquiry show that most countries and regions expect an increase in prioritisation activities in the future (See Box 1.14). The challenge posed by smart specialisation is how to bring the results obtained from the 'self-discovery' process (knowledge exchange between the public and private sector) into prioritisation, in order to both engage in strategic co-ordination and fine-tuned priorities. The analyses indicate areas where additional efforts are needed. These can be grouped as follows:

Challenges for fine-tuned 'activities'

- Current priority setting processes mainly target broad domains (life science, biotech, health; ICT; Environmental technologies; mobility and logistics; and new materials), whereas smart specialisation requires narrowing down these broad domains into 'activities' of competitive advantages (See Box 1.14 for examples of specific niches within broad domains).
- Not all regions choose to prioritise between thematic domains or support quite a broad set of domains or functional priorities (e.g. Lower Austria and South Moravia).
- There is little information on how decisions/priorities are adopted (e.g. empirical evidence basis used is not clear or possibly masks a factual lack of decision making mechanism)).
- There is a need to increase the inter-linkages between quantitative and qualitative inputs into strategy formation process, prospective data and analysis.
- Selecting and engaging key actors, necessary for their expertise and knowledge, is an increasingly difficult task due to the cross-border, multi-disciplinary and cross-sectoral dimensions of emerging activities.

Box 1.14. Increased attention to priority setting in selected OECD countries and regions

Countries and regions covered by the OECD-TIP enquiry recognisethe growing importance of the prioritisation of innovation policies in the future. Those who have recently engaged in such a process, opted for a deepening of the existing broader priorities rather than starting a completely new process. In the enquiry, there were no cases of countries or regions planning to withdraw from a policy prioritization process.

Countries		Regions	
Australia	⇨	Lower Austria	⇨
Austria	⇧	Upper Austria	⇨
Czech Republic	⇨	Flanders	⇧
Estonia	⇧	South Moravia	⇧
Finland	⇧	Lahti	⇨
Netherlands	⇨	Berlin/Brandenburg	⇨
Poland	⇨	Brainport Eindhoven	⇨
South Korea	⇧	Malopolska	⇧
Spain	⇨	Gwangju	⇨
United Kingdom	⇧	Andalucia	⇧
		Basque country	⇧

⇧ Intensity of prioritisation is expected to increase ⇨ Intensity of prioritisation is not expected to change

Box 1.15. Examples of specific niches within broad priorities

Lower Austria

- *Broad priorities:* Life science, biotech, biomedicine, pharma, health, ICT, Environmental technologies, energy, Nanotechnology, materials and agrifood.
- *Niches:* Analysis of biological materials, and medical technology: agrobiotechnology and environmental biotechnology: Bioanalytics, environmental biotechnology, crop breeding, utilization of natural resources, pharmaceuticals; Blood purification systems, tissue engineering, cell therapy, cell biology and physiology, ICT visual computing, building physics and energy systems, Materials, tribology (friction, wear, lubrication), medical technology, sensory technology and actuators, surfaces, Green building, Food safety and Bioplastics

Korea

- *Broad priorities:* Life science, biotech, biomedicine, pharma, health and ICT.
- *Niches:* Green technology industry (New renewable energy, Low-carbon energy, Water technology, LED application, Green transportation system and High-tech green city); State-of-the-art fusion industry (Media Communication fusion, IT fusion system, Robot application, New materials and nano-fusion, Biomedicine and medical devices, High value-added food industry); High Value-added service industry (Global healthcare, Global education services, Green financing, Contents and software and Meetings, Incentives, Conventions and Events and tourism industry)

Brainport Eindhoven Region, Netherlands

- *Broad priorities:* High Tech Systems, Life science, Energy, Design.
- *Niches:* Smart Mobility, Solar and energy in built environment, Smart Materials, LifeTec&Health (including Homecare), Design.

Source : OECD-TIP enquiry in governance for smart specialisation

Public action to support entrepreneurial bottom-up initiatives

In line with the 'entrepreneurial bottom-up initiatives' (referred to in the section on "Development of Specialisation Strategies" above), governments also take actions in order to engage and improve the communication with stakeholders for further strategic co-ordination and fine tune priorities setting. Some national governments, such as Finland and Australia, organise regional panels to detect direct needs and to identify emerging opportunities at regional level. The results have a direct impact on national strategies. Other regions, such as South Moravia, have seen the benefits of increasing the absorptive capacity of their staff inside the regional governments for an efficient "self-discovery" process.

Policy instruments for smart specialisation

The following chapters inquire on the policy instruments and their potential impact on sprouting bottom-up initiatives of entrepreneurial networks: and achieving their primary goal of transforming economies into more competitive, job-rich and sustainable ones.

Linking policy instruments to priorities

Smart specialisation encourages an outcome-driven approach to policies. That is, linking actions to objectives, connecting opportunities to assets, and policy instruments to priorities. The most common policy instruments used to support specialisation range from dedicated budgets, institutions, clusters initiatives, strategic investment, venture capital, education and training. Nevertheless, in many countries and regions, there is no clear articulation of priorities (e.g. stated in policy documents) and policy instruments in place. The main barriers to translate policy documents into policy actions have been grouped as follows:

Table 1.3. Evidence from the governance enquiry and case-studies

Bottleneck	Challenge
Stickiness of public allocations to existing priorities/areas.	Developing flexible policy tools to 'shift' public support towards new priorities.
Loosely defined priorities (e.g. listed as possible intervention areas rather than genuine priorities).	Ensuring political commitment.
Horizontal fragmentation in policy-making (e.g. priorities are between or beyond traditional policy areas).	Adopting a synergic approach from different fields of policies (e.g. research, technology, innovation, industrial, education and training).
Lack of means and tools to assess the relevance of certain actions to contribute to the priorities.	Developing policy tools with measurable goals.
Proliferation of policy frameworks (e.g. activities that go beyond administrative borders).	Simplifying or de-fragmentising policies. Removing regulatory barriers.

Source: OECD TIP governance enquiry and case studies

Policies for "entrepreneurial discovery"

Compared to the traditional policy instruments for STI, the efficient 'self-discovery' process that is required for smart specialisation puts emphasis on the need of policies focused on:

- *Incentives for entrepreneurs: i)* to reward those entrepreneurs who discover new domains and activities (information externality problem) and; *ii)* to attract other agents and firms and facilitate entries so that agglomeration and scale effects materialise at the next stage.

- *Building inter-regional linkages:* to detect knowledge/capabilities/technologies located in other regions. Together with general policy for STI co-operation (e.g. staff exchange, participation in conferences, joint research programmes), smart specialisation requires special attention to policy measures in order to: *i)* improve the absorptive capacity of the socio-economic stakeholders (including public staff and SMEs) and; *ii)* facilitate the mobility of highly skilled.

- *New mechanisms to detect novel ideas:* The policy challenge here is how to incentivise firms to reveal and share information on their experiments and explorations, in order to support discoveries, identify complementarities and connect capacities. Most case studies do not provide information regarding how novel ideas are to be assessed for policy support, and how long such support might be provided for.

- *Supporting experimentation:* emerging 'activities' may lack evidence-based potential economic value, opportunities for new start-ups or technology exploitation for existing companies. New tools are required to help policy makers to assess the potential of emerging activities for future economic growth, in order to support them.

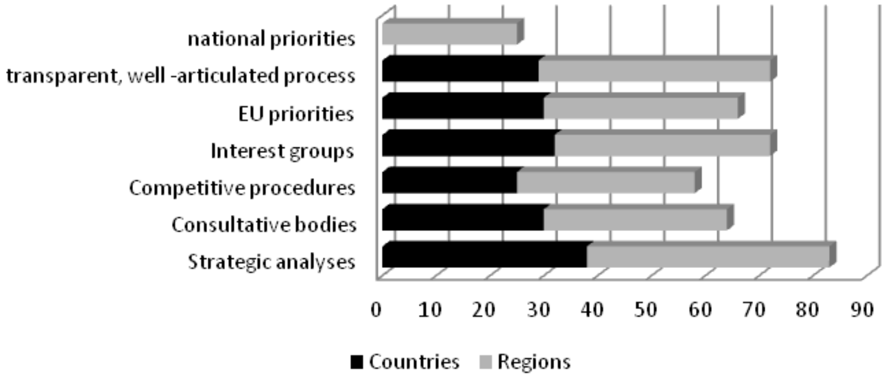
- *Educational programmes:* updating the skills required by the increasingly cross-sectoral and cross-technology activities (e.g. university level training in mechatronics in Upper Austria as a reaction of a new specialisation evolving from machine building).

Policy intelligence

The role of strategic policy intelligence as a tool for governance of smart specialisation is important. Smart specialisation emphasises the need to align policy actions to priorities in order to build a critical mass in emerging activities, develop a vision and implement the strategy. The policy community requires tools to allow governments to assess the viability, not only of existing strengths, but of the ambitions and future plans (roadmaps) of the entrepreneurial organisations asking for government support. This may require a different type of assessment tools, but perhaps more importantly a reference framework of criteria in order to adequately select and de-select.

Overall, strategic analyses are declared as one of the most important influence on the selection of priorities, both for regions and countries (Figure 1.2). The influence of stakeholders, either individually through the action of interest groups, or collectively through the action of consultative bodies, is also a key vehicle through which the priorities are determined. Priorities set at higher level (EU priorities, national priorities for regions), also influence the choices. The only vector which seems a bit less common is the use of competitive procedures to elicit the priorities. Amongst all these sources of influence, there is no clear difference between the process at play in regions or in countries.

Figure 1.2. Influences on the selection of policy priorities



Note: Countries: 9 respondents. Regions: 11 respondents
Source: OECD-TIP enquiry in governance for smart specialisation

Other intelligence policy instruments identified in the case-studies include:

- Using demand-side instruments, such as, public procurement policies oriented towards the promotion of innovation and the development of new markets: or supply-demand policies to link the needs of the industry to research activities. For example, world class technologies can only be used by firms which benefit from using the new knowledge and have internal capabilities to do so.

- Developing mutual learning practices to provide policy makers opportunities to learn from good practice examples but also failures carried out by other governments.

- Relying on expert support to improve the stakeholder's involvement during the priority-setting and policy-making process.

- Using participatory Foresight exercises in the priority-setting and policy making process in order to explore potential futures and to develop shared normative visions of the future (*e.g.* Normative Foresights with back casting, Strategic Road mapping exercises to identify existing bottlenecks and to align policy instruments to a shared vision and priorities, Online Delphis with regional and international experts and stakeholders to identify emerging issues and trends, Systemic Foresight Methodology).Fostering a structural transition from policymaking to cycles of policy development and policy learning once smart specialisation becomes more and more adopted as an economic policy concept.

- Developing monitoring and evaluation systems geared to smart specialisation. This is discussed in the following session.

Monitoring and evaluation mechanisms for smart specialisation

Smart specialisation places a strong emphasis on the need for policy makers to carry out *ex ante*, mid-term and *ex-post* monitoring and evaluation, and to feed the results back into policy design. As a source of strategic intelligence, the role of evaluation is to generate information about the appropriateness and effectiveness of public policy intervention (OECD 2012). The results may help policy makers to account for public spending choices (*ex ante*), re-positioning policies and public support towards new priorities (*mid-term*), and to learn from past failures (*ex post*). Nonetheless, the development of monitoring and evaluation systems specifically geared to smart specialisation is either under preparation or inexistent (See box 15).[16] According to the results of the governance enquiry, some of the challenges for efficient monitoring and evaluation mechanisms for smart specialisation are:

- Responders of the enquiry were not able to provide a strategic view of the policy instruments, policy mix and public budgets dedicated to the priorities.[17]

- There is an unclear view on public allocations to the prioritised areas preventing policy-makers to assess the relevance and effectiveness of their policies.[18] Clear benchmarks and criteria for success and failure are needed.

Box 1.16. Examples of monitoring systems incorporating a view on prioritized areas

Lower Austria: "There is a balanced scorecard tool to monitor the regional strategy, one covers the clusters and the other one the Technopoles. It includes performance data such as publications, critical size, collaborative projects etc. The Monitoring helps to "fine-tune" the Strategy... Decreasing performance figures of the Wellbeing Cluster shown in the Balance Scorecard monitoring resulted in the decision to stop this cluster initiative.";

Brainport Eindhoven: "the main instrument is the Brainport monitor, an annual report that analyses the region on about 40 statistical indicators on people, technology, business and basics. It contains trend analysis, benchmark with national average and, where possible other European Innovation Regions (Regional Innovation Scoreboard top 20). The monitor also includes an analysis of about 30 reports with qualitative and quantitative analyses on Brainport relevant topics like global location trends, raw materials, talent etc.";

Netherlands: *i)* Formulating indicators for general policy, specific instruments and specific economic sectors. *ii)* Transparency: a 'follow the money' website. *iii)* Dashboards that describe the ambition, goals, and activities for every sector, with corresponding indicators and target values."

Source: OECD TIP enquiry in governance for smart specialisation

When designing monitoring and evaluation activities for smart specialisation, both for the priority-setting and evaluation of programmes, governments may want to consider:

- Involving external expertise as needed (external expertise assessment method). This would counteract the influence of vested interests and provide a neutral and evidence base to decision-makers in order to help them strike a balance between various pressures from interest groups.

  Developing policies with clear measurable goals, whether it involves an increase in business R&D, R&D commercialisation or research excellence.

- Making use of problem definition and structuring methods such as logic framework analysis and logic chart analysis to provide for a coherent intervention logic and clearly defined indicators for inputs, activities, outputs, outcomes and desired impacts.

- Developing pilot exercises on implementing 'Smart specialisation-oriented' public budget pictures of budgets allocated to each prioritised areas by aggregating: *i)* Budgets allocated to dedicated bodies and programmes (e.g. institutes, centres, R&D programmes, clusters); *ii)* Budgets allocated through preferential treatment in generic programmes; *iii) Ex post* money received by prioritized areas in generic programmes.

- At regional level, governments may want to include in their budgets regional, national and EU (for EU regions) money flowing to the priority areas.

Summary

Governance for smart specialisation requires strategic capacities to grasp future opportunities. This includes: the capacity to identify local strengths; the ability to align policy actions and to build critical mass; and the ability of regions to develop a vision and implement the strategy. The role of strategic policy intelligence as a tool for governance of smart specialisation is therefore important. In practice, the link between policy instruments and the priority setting is not explicit in the vast majority of regions and countries. Many policy makers find it difficult to move from the "priority setting process" to the process of developing policy instruments and the corresponding budget. In most cases, the prioritisation process is disconnected from the budgetary process. Additional governance challenges include increasing the absorptive capacity of key actors and staff inside the regional governments which is crucial for an efficient "self-discovery" process: the latter is especially a challenge for smaller and remote regions. The variety of policy mechanisms (entrepreneurial discovery, intelligence and monitoring/evaluation) highlights the complexity of the challenges policymakers face. Taking those different policy components as one whole inevitably leads to the insight that policymakers have to move beyond policymaking into the realm of policy development & policy learning. The emphasis on policy learning is one of the key elements (alongside the concept of entrepreneurial discovery) of smart specialisation.

NOTES

1 However, the choice as to whether the smart specialisation strategies should be prepared at a regional level or a national level rests with the EU Member states.

2 See also (EC 2011) Final Report on High Level Expert Group on Key Enabling Technologies. Available at *http://ec.europa.eu/enterprise/sectors/ict/files/kets/hlg_report_final_en.pdf*; See also page 21 of this report.

3 Some case studies in the OECD appear to interpret smart specialisation as necessarily involving prioritising 'sectoral cluster', 'sectoral strategic plans' or 'cluster strategy', for example, the Photonics Cluster (Gwanju, Korea); Automotive Cluster (East Marmara, Turkey and West Midlands, United Kingdom); Aeronautics Cluster (Andalucía, Spain).

4 "Place-based policies" can be defined as those policies that take into account the spatial dimension of economic activities. For example, developing labour markets or innovation in a city or in a rural area may not entail the same type of instruments and may require a differentiated approach. Policies that are "space-blind" may miss this element of differentiation and thus are not the most effective way of promoting growth in all types of regions (OECD, 2011).

5 See also EC-IPTS S3 (2012) Guide on national/regional Research and Innovation Strategies for Smart Specialisation (RIS3) *http://s3platform.jrc.ec.europa.eu/s3pguide* at page 87 and annex II at page 65.

6 Also referred as 'Standortpolitik' in German.

7 OECD-TIP enquiry in governance for smart specialisation (10 respondents from regional governments and 10 from national governments).

8 COM(2010) 553 final of the European Commission.

9 For example, Universities can provide private and public authorities both with strategic advice and experts to work directly on regional development priorities. The role of Universities as a critical 'asset' of the region may be even higher in the less developed regions, where private sector may be weak or relatively small, with low levels of research and development activity. Among the mechanisms by which universities can contribute to regional innovation systems are: *i)* stimulating the entrepreneurial spirit of its staff and students; *ii)* providing advice and services to SMEs; *iii)* participating in schemes promoting the training and placement of high level graduates in innovative businesses; *iv)* hosting incubators for spin-offs in science and technology parks and; *v)* providing input to innovative clusters and networks. See also EC-IPTS (2011) 'Connecting Universities to Regional Growth: A Practical *Guide*'. *http://ipts.jrc.ec.europa.eu/activities/research-and-innovation/documents/connecting_universities2011_en.pdf*

10 On July 14th, 2010, the European Economic and Social Committee approved an opinion report about the role of science and technology parks which recommends that the European Union (EU) needs a strategy to maintain and develop the XXI century parks. The paper encourages the development of new generations of parks and innovation structures and explains that the parks are increasingly seen as instruments to accelerate economic development and international competitiveness.

11 With open innovation in the core of Brainport's development strategy - along with new forms of participation-, the Eindhoven triple helix model has actually transgressed towards a quadruple helix structure in which innovation users, most importantly B2B, are already part and parcel of the Brainport model.

12 The RIS3 KEY was an idea and contribution of the Austrian Federal Ministry of Science and Research (BMWF). The RIS3 KEY for self-assessment was developed by Joanneum Research Graz, in co-operation with and funded by BMWF.

13 In South Moravia, Innovation Centre (JIC) was established in 2003. The region of Malopolska has reshaped their multilevel governance system over the last decade, especially regarding innovation and science, leading to decentralization of the public administration, building of a regional strategic management system and preparation of

regional documents. These tools contributed the region and provided possibility to enhance their competitive advantages nationally and globally. In Flanders, innovation policy has a relative recent history. From the 1990s, the progressing federalization of Belgium has provided the Flemish community and region with an extensive mandate in science and innovation policy.

14 For example, nanotechnology for health in Flanders.

15 In Lower Austria, two cluster initiatives which initially enjoyed public support were discontinued due to the weak support received by companies active in their respective sectors. Namely, the Automotive Cluster Vienna Region (ACVR) and the Wellbeing Cluster of Lower Austria.

16 An exception is the UK that mentioned the existence of monitoring systems looking at the priority areas. Evaluation systems are being developed in Poland and the Netherlands to monitor Top Sector policies.

17 The way through which policy instruments serve the priorities and the split of budgetary allocations to the prioritised areas could not be elucidated through the enquiry. Accordingly, monitoring and evaluation systems, when in place, are not (yet) geared towards the follow-up and assessment of the prioritization of policy.

18 The governance enquiry reveals that in many cases there is a dissociation between: priorities stated in policy documents but not translated into policy instruments; de facto prioritization is not declared in policy documents; or there is an inconsistency between expressed priorities and actual use of targeted instruments.

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PART II – CASE STUDIES ON SMART SPECIALISATION

The case studies provide an in-depth analysis of real-life experience in policies and governance mechanisms for building smart specialisation strategies. Participating countries and regions have been provided with a template that focuses either on a particular domain (vertical template) or on the regional strategy process for smart specialisation (horizontal template). However, case studies present differences in the use of the template and the granularity of their descriptions and analysis according to the needs of the national or regional context. The case studies have been grouped in vertical and horizontal cases, indicating the country, the region (when the case has a regional focus) and the title of the case-study.

AUSTRALIA: GRAINS RESEARCH AND DEVELOPMENT CORPORATION (GRDC)

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Definition of the eco-system and its boundaries

In Australia Rural Research and Development Corporations (RDCs) are major funders of research and development (R&D) in Australian primary industries, investing AUD 441 million in R&D in 2008-09, covering a range of priority areas including productivity, climate change and natural resource management. This amount included AUD 244 million of industry investment and AUD 207 million in Government matching contributions. The structure of the RDC model and the extensive collaboration between industry and researcher stakeholders involved, promotes research, development, innovation and extension of research findings. Priorities are industry driven, identified through industry consultation and reflect important issues for both industry and government. The ability to tackle projects jointly increases efficiency and can result in more effective communication and uptake of the outcomes of R&D. This contributes directly to innovation driven productivity growth in Australian agriculture.

The Grains Research and Development Corporation (GRDC) mandate is to plan, invest and manage research and development for 25 grain crops spanning temperate and tropical cereals, oilseeds and pulses. The GRDC's vision is for a profitable and sustainable Australian grains industry, valued by the broader community. Its mission is to create value by driving the discovery, development and delivery of innovation in the Australian grains industry. The GRDC works closely with its two key stakeholders – Australian grain growers and the Australian Government. It also maintains strong relationships with research partners, other RDCs, grower groups, and private investors. The value chain for grain growers consists of four stages – pre-seed breeding, seed breeding, on farm practices (e.g. the planting, growing and harvesting of the crop) and post production processing. GRDC collaborates with key private actors in the value chain at every stage.

The knowledge base regarding grains innovation in Australia is formed from a number of sector surveys, based on Oslo Manual methodologies. These surveys indicate that levels of innovation in the grains industry are higher than those in agriculture more broadly:

- The Australian Bureau of Statistics (ABS) included agriculture, fisheries and forestry industries in its annual Business Characteristics Survey for the first time in 2009-10. Collection of data is undertaken based on a random sample of approximately 9 000 businesses. The sample was stratified by industry and an employment-based size indicator.
- The Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES) Farm Innovation Survey was first conducted in 2008. Data from the survey is used to monitor trends in farm innovation, evaluate impacts on agricultural productivity and improve the linkages between public R&D and rural industries. Furthermore, the data allows the grain sector to develop its own benchmarks for innovation to ensure agriculture does not lag behind the national push to develop broader skills and capacity needed for innovation[19].

The GRDC is one component of the rural RDC system – a system comprised of fifteen RDCs. It has linkages with the other fourteen RDCs through the Council of Rural Research and Development

Corporations (CRRDC). GRDC has longstanding international research alliance agreements with the International Maize and Wheat Improvement Center in Mexico and the International Center for Agricultural Research in the Dry Areas in Syria. GRDC also has a Memorandum of Understanding with the International Crops Research Institute for the Semi-Arid Tropics in India.

Key features of the cluster/domain

The grains industries that participate in the GRDC are comprised of 25 crops. These industries are dominated by one crop (wheat) and contain another four major crops (barley, canola, oats and sorghum) and twenty relatively minor crops. All of these grain crops can be placed into three broad categories – coarse grains, pulses and oilseeds. Across Australia there are over 24 000 grain growers.[20] Critical to growers' continued success is access to new information, products and services made possible through on-going R&D and innovation. The GRDC investment in R&D represents approximately a quarter of the total investment in Australian R&D for grains[21]. Australian agriculture contributes on average approximately 3.2% of Gross Domestic Product (GDP) (as measured between 1999-00 and 2005-06).[22] When all of the value added activities occurring post farm, and all of the activities supporting farm production (inputs) are added, agriculture's contribution to GDP rises to 12.1%. Approximately 53% of Australia's land mass was used for agriculture in 2010-11.[23] Grain production represents the largest industry in many rural and regional communities and it is an important source of foreign income for Australia.

The scale of the Australian wheat industry is larger than the combined total of all the other GRDC industries. Australian wheat exports form a significant part of the global wheat trade – in 2010-11 Australian wheat made up 16.6 % of total global wheat exports and it is the most valuable agricultural export from Australia.[24] Exports of Australian wheat are forecast to generate USD 6.1 billion[25] during 2011-12. Australian agricultural producers receive government funding support for just 4% of their income, the second lowest in the OECD after New Zealand.[26] The exposure of the Australian grains industry to international competition ensures that innovation driven productivity growth is a consistent grower priority.

Regional, national and international policies that have been decisive for prioritisation of domains

The GRDC Board oversees corporate governance, sets strategic direction and monitors the on-going performance of the GRDC. Board members are appointed by the Federal Minister for Agriculture, Fisheries and Forestry on the recommendations of an independent selection committee. Regional priorities are the key determinant in setting the R&D priorities for GRDC each year. Growers receive reports on performance through several mechanisms including: *i)* regular updates via GRDC publications and forums; *ii)* the GRDC Annual Report; and *iii)* the "Growers Report" – an overview of R&D investment in the pipeline. Growers participate in regional Annual General Meetings and elect panel representatives. The panel prioritisation process occurs by regional panels collecting grower priorities and synthesising these at a National Panel. The GRDC's three regional panels cover the northern, southern and western grain growing regions of Australia. They are made up of grain growers, agribusiness practitioners, scientists and the GRDC's Executive Managers, with provision for other industry experts to participate as appropriate. The National Panel is composed of the chairs of the three regional panels, the Managing Director and the GRDC's Executive Managers.

Five year strategic research and development plans are developed by the GRDC in consultation with growers in order to capture the medium and long term priorities for the industry in a series of key themes. These themes guide investments and research topics over a five year period. Most investments are made over multiple years, so only approximately one third of funds are available each year for new investments. The Australian Government's guidance in regard to RDCs' research focus comes via the national and rural research priorities. These priorities are very broad, and intentionally leave the RDCs with considerable autonomy in the selection of projects. The Australian Department of Agriculture, Fisheries and Forestry has periodic meetings with the RDCs, which provide an opportunity to clarify and reinforce the Government's priorities.

The GRDC's mission also reflects the Australian Government's national innovation priorities which focus Australia's innovation efforts to strengthen the national innovation system. The GRDC uses a variety of methods to consult with industry representatives. Communication and feedback is facilitated via state conferences, newsletters and surveys. The GRDC has established dedicated regional forums to elicit stakeholder input. All grain growers in Australia are required to contribute to GRDC operations via a 1% levy on the sale of grain. This compulsory levy ensures that there are no free riders in the industry. In 2011-12 the GRDC invested AUD 151 million in more than 900 projects across 230 organisations, employing approximately 1 300 researchers, administrators and agribusiness personnel.

Future development of the cluster: grasping the opportunities for smart specialisation

In order to identify future priorities, GRDC: *i)* approaches investment using programme logic; *ii)* consults extensively with stakeholders, particularly growers; *iii)* maintains strong networks with researchers and these networks alert it to opportunities for world-leading research; *iv)* monitors international developments in grains R&D and applies them locally when possible; *vi)* conducts periodic situational analyses of its stakeholder industries; and *v)* commissions other agencies to study aspects of the grains industry when required. In its 2012-17 Strategic plan the GRDC has identified six strategic themes to focus investment and will deliver practice change on farm. These themes are grower centric, consistent with GRDC's commitment to deliver value to growers: *i)* meeting market requirements; *ii)* improving crop yield; *iii)* building skills and capacity; *iv)* protecting your crop; *v)* improving your farm resource base; and *vi)* advanced profitable farming systems.

GRDC determines future priorities on the basis of maintaining a balanced portfolio of investments. This balance not only relates to risk; GRDC also strives to balance its research portfolio in terms of short, medium, and long term projects. It also seeks to balance research activities and activities that encourage uptake and it seeks a balance between wheat and all other crops in its portfolio. Recognising that the Australian grains ecosystem is connected across the Australian and global economies the GRDC designs its priorities to be compatible with other regional, national and international drivers such as: *i)* State governments multi-year plans for agricultural and regional development*; ii)* Australian Government plans such as the National Food Plan; *iii)* international competition*;* and *iv)* The Australian Government invests significant resources to increase food security in other countries as part of its aid budget. In the years 2006 to 2011 the Australian Government's aid budget doubled.[27]

There are a number of bottlenecks/threats that could affect the future of the Australian grains industry. Based on consultations with grain growers, the Australian Government, research partners and other stakeholders, the GRDC has identified the most likely drivers of change in the GRDC's immediate and broader business environments over the next five years. They include: grain market characteristics; environmental issues; government policy and regulatory requirements; R&D and delivery; and customer expectations and social issues.

Lessons learned and conclusions for policy

- *Bottom-up priority setting*: The greatest strength of the RDC model is its ability to capture the R&D priorities of end-users and involve them directly in the process of innovation. The GRDC priority setting process utilises a structure of regional panels and grower consultations to establish the key issues for its 24 000 end-users (grain farmers). This system ensures that producer and researcher priorities do not diverge from each other.

- *Effective buy-in:* The end-user levy arrangements that underpin the funding of GRDC provide a stable source of funds, facilitating a longer term approach to research than organisations operating on insecure annual funding agreements. Compulsory levies were essential in addressing the free rider issues that had existed in previous R&D programmes. Levies also ensure that end users take an active interest in the investments and the resultant research. GRDC capitalises on the interest of growers in its projects by providing education for growers on relevant sciences so that they can effectively engage with researchers. This outcome is of mutual benefit - researchers have a greater understanding of the on-farm impacts and more effective research increases on-farm productivity gains.

- *Network with similar bodies:* The ecosystem needs to be aware of potential collaborators, both locally and internationally. Experiences of peers and competitors can be important warnings of upcoming challenges to a cluster. Consequently the maintenance of extensive networks amongst peers, competitors and related industries is essential.

- *Open innovation:* Open innovation refers to the practice of using knowledge and expertise from outside an organisation to accelerate the process of innovation. The use of an open innovation model in sourcing R&D services allows GRDC to flexibly engage in multiple specialised fields of research as required by its priorities. Specifically, the GRDC is using a programme logic approach to look at what RD&E is required and then enacts its strategy through bottom-up prioritisation.

NOTES

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FLANDERS, BELGIUM: NANOTECH-FOR-HEALTH

Johan van Helleputte (IMEC), Marc van Rossum (IMEC) and Patries Boekholt (Technopolis)

Definition of the eco-system and its boundaries

The Flemish case focuses on the process of diversification strategy of the Flemish nano-electronics research and technology actors, particularly imec by means of cross-fertilisation with the Flemish based health research and medical sectors, in order to develop a new economic domain: *Nanotechnology-for-Health* (NfH). This process of diversification is based upon a unique set of underlying nanotechnology platforms and nanotech competencies of the research centre imec and linking it with another strong domain in Flanders: biotechnology, health and medical devices. The domain of nanotechnology for health (and for medicine) is identified by international market studies as an emerging market. In this case, the complementary assets of two R&D intensive domains that so far have not worked together, could potentially form a 'new combination' and thus an opportunity for the Flemish ICT and pharmaceutical industries to diversify. Innovation in the health domain is a *societal challenge*, shared by many regions and by the Flanders Government as well.

Key features of the cluster and key assets that drive entrepreneurial discovery

Imec is a key player in nano-electronics (world level recognition and specialisation and considered as one of the largest independent research institutes in its field). Imec can supply general purpose technologies (technology platforms) for a broad range of application fields. As such, Flanders can act as a smart specialist in the Flanders region in *nanoelectronics technology platforms* at a regional level, as well as in European and global level, integrating both the technology life cycle and the value chain players in different application domains. During the past 28 years, imec has grown into one of the largest *independent* research labs in nanoelectronics in the world, based upon a fairly unique open innovation model. Imec is *one pillar* in the region for underpinning a smart specialisation claim for the region in NfH.

Flanders has also a very strong and internationally highly recognized biotechnology R&D Institute (VIB), another *major pillar* situated in the Flanders region. In a range of complementary areas of *Nanotech for Health*, there are outstanding, internationally recognized top-research teams active in the 5 universities of the region. Furthermore, one of Europe's largest University Hospitals is located in Leuven (Gasthuisberg), with a strong expertise in complementary fields within the other three University hospitals in the region. The clinical infrastructure in the region is a third outstanding trump card. Finally, Flanders has a relatively strong position in terms of biotech and pharmaceutical companies, which are, for instance, illustrated by a strong share of Belgian patents applications in this domain, the third largest in Belgium; and the appearance of pharmaceutical companies in the list of main private sector R&D performers in Flanders.[28] Belgium accounts for a remarkably high proportion of Europe's turnover in biotechnology. It represents 16% of the European biopharmaceutical industry, placing the country as a key player at world level. Nearly half of this turnover is based in Flanders.[29] These numbers show strengths of the region both in research and industry. Today, NfH is not a cluster with a clearly defined set of actors, with any institutional or formal arrangements or with a clear agenda. It is a loosely defined technology domain where actors share a strong belief in their potential to: *i)* address the societal issue of health and aging; *ii)* to create economic value for the Flemish economy; and *iii)* to help Flanders to obtain a strong position in European networks in this domain.

While the initial strategy development (the entrepreneurial discovery process) started from one research centre, during the course of the OECD-TIP exercises, a wider set of stakeholders – universities, academic hospitals, companies from the health sector and health insurers and ultimately a set of cluster organisations – have been involved in the process. The goal of taking part in the case study is to create conditions for accelerating the strategic positioning of complementary partners by use of a strategic intelligence and eco-system management. A strong element of this process is a competence mapping exercise developed by imec in co-operation with ECOOM to assess the specialisation patterns of the regional 'knowledge providers' and simultaneously the expectations of potential impacts of combined technologies. This mapping exercise was needed in order to estimate strengths at the cross-roads of specific pathologies, medical technologies and nano-electronic technologies. The potential user community (e.g. care-providers, insurers, companies) were asked to rate the potential impacts of particular technological breakthroughs on these cross roads. In this process, workshops were held to explain the objectives and potential benefits. These were followed up by surveys of individual organisations. The research organisations were asked to make a self-assessment of their strengths on particular topics. The participation in this process was widespread and response to the surveys extremely high. Thus the process hit the right nerve in the community.

Regional, national and international policies that have been decisive for prioritisation of domains

So far, the Flemish government´s involvement in this emerging initiative has been on the background. The current strengths in research have been a result of years of investment in the strategic research centres imec and VIB. Fundamental research – which NfH is mostly - resides in the science and innovation policy domain. In the Flemish administration, the Department of Economy, Science and Innovation (EWI) has this responsibility. Traditionally, the main policy instruments in this domain have been the basic support for Strategic Research Centres in a particular technology domain, (e.g. imec for micro- and nano-electronics, and the Flemish Institute for Biotechnology (VIB) for biotechnology and life sciences). NfH is a domain that crosses these institutional boundaries and combines knowledge and expertise built-up in different scientific disciplines, with only a young history of trans-disciplinary collaboration. Public funding streams are split between these institutions on the basis of specific performance contracts. That doesn't mean that the Flemish government only funds these separate centres. On the initiative of actors from the research community (imec, VIB and the Catholic University of Leuven), a dedicated centre for bringing together neuro-sciences and electronics was granted a one-off co-funding to set up a trans-disciplinary laboratory. This is called the Nerf initiative launched in 2009. Thus, the Flanders government has already shown to be able to respond to new initiatives that are put forward bottom-up by entrepreneurial actors.

The *White Paper Science and Innovation 2009-2014* identifies health as one of the main societal challenges and priority fields for action. The document announces that one of the "large flagship projects' will be set up in this domain. But no further strategies for science and innovation in the domain of health are elaborated in this long term strategy. The bi-annual *Policy Brief Science and Innovation Policy Priorities 2011-2012* is more specific. Six *Innovation Hubs* are defined, including one in the area of health called "Health care innovation" with a strategic focus on ageing, health and emancipation. The initial activities supported under the "Health Care Innovation" Hub are taken up by a newly set up platform organisation Flanders Care. Flanders Care supports innovations in health care and in terms of technologies, focuses on logistics, ICT and organisational innovations to improve the quality and efficiency of care. Thus, the more long-term fundamental research and technologies that NfH is aiming for, do not fit within the current focus and strategies of the Flemish health-related *Innovation Hub*.

The policy department encourages the development of a diversification strategy that links closer the local economic potential because imec is an international institute that mainly deals with foreign companies in the field of semi-conductors. The topic nano-for-health addresses one of the key societal issues (health), high on the policy agenda. But the NfH initiative itself is not a part of any of the "Innovation Hubs" or cluster structures supported by the Flemish government yet. The entrepreneurial discovery process is very young and bottom-up driven. While the strength in terms of available science and technology expertise is evident, the question whether NfH has a potential economic value for the Flemish economy is difficult to predict. Whether there are opportunities for new start-ups or technology exploitation for existing Flemish companies is too early to say as the foreseen technological breakthroughs are still very far from commercialisation. The involvement of the company sector in the mapping exercise and their cluster organisations in the further take-up of the initiative is a good sign.

The dilemma for policy makers, as well as all actors, is to estimate the likelihood of future economic growth of such an experimental domain. In the case of Flanders, the dilemma is also whether the region is large enough to carry the burden of investment needed in future research and research infrastructure. Thus, an urgent step for this smart specialisation case is to ensure alignment with EU developments in these areas. Indeed, the key partners already work on partnerships across the border to be prepared for Horizon2020 activities. Thus, such a case that aims to change paradigms needs a multi-governance approach be pushed further and create the critical mass needed in order to play a role globally.

Future development of the cluster: grasping the opportunities for smart specialisation

The mapping exercise created enthusiasm shared by a wide set of stakeholders from research and industry. Three cluster organisations that had previously not worked together (DSPValley on embedded systems, Pharma.be the business network in the health industry and FlandersBio a cluster organisation for the life sciences and biotech) have agreed to take up the work set out by imec further and see whether this can be developed into a wider joint agenda. The challenge is that this type of process needs a large effort in mobilising people and resources. The Flemish government could consider this bottom-up initiative as a so-called "light-structure" to receive a financial support mostly for network management and strategic agenda-setting processes. Alignment to European and even global initiatives in this field is foreseen.

Lessons learned and conclusions for policy from the NfH case

- *Strong lead actors:* the case demonstrated the importance of strong lead actors committed and positioned to mobilise other stakeholders and to set a strategic framework for further actions. In the case of NanoforHealth, imec took a lead role in defining the potentially new domain by combining its own expertise with complementary expertise in the region, developing – together with ECOOM – a method of mapping the multidisciplinary expertise in this field, motivating the (public and private sector) actors and in taking part in the mapping exercise. This preparatory activity is subsequently taken up by the existing cluster organisations in adjacent domains, which will explore the possibilities to build a similar "light structure" and transform this loosely emerging domain into a more self-organising network.

- *Level of self-organisation:* supporting entrepreneurial bottom-up initiatives needs to rely on a level of self-organisation of a number of actors who have the position and commitment to mobilise other stakeholders. If there is little support from a variety of actors (e.g. promoted by one single research centre or one company), the likelihood of success is small.

- *Extensive basis of value added resources*: the case study shows that bottom-up entrepreneurial discovery processes do not emerge from completely unknown actors. We can see that there is already an extensive basis of value added resources (e.g. research excellence, companies, skilled people, knowledge, money and infrastructures) in the Flemish fabric. The case shows that the new potential for future growth is based on diversification and combination of existing strengths.

- *Governance challenges:* the case study shows that in particular specialisation areas that cross the borders of policy domains, a common and coherent approach to cluster initiatives is faced with additional governance challenges**.** The habit of compartmentalised policy making prevents a joined up approach that could help to boost emerging areas through the combination of research and innovation support, adaptation of regulation, demand side policies, etc. In Flanders, the lack of a coherent approach to health (care) innovations from various ministries is an example.

- *Methodological tools:* The fifth policy lesson is that a number of actors operating in the 'mid-field' and initiators of strategic prioritisation processes – either in their own domain or across domains – have developed their own methodological tools to: *i)* analyse existing strengths (mapping the status quo); and *ii)* conduct forward looking analyses to define the road ahead. This is an important process to support and facilitate.

NOTES

[28] ECOOM, Vlaams Indicatorenboek 2011.

[29] Belgian Foreign Trade Agency, Belgian Biotechnology (2011)

FLANDERS, BELGIUM: SUSTAINABLE CHEMISTRY

Carl van der Auwera (Essenscia), Ludo Diels (VITO) and Jon van Til (Technopolis Group)

Definition of the eco-system and its boundaries

The second Flemish case is about a new cluster initiative called FISCH (Flanders Innovation Hub for Sustainable Chemistry). FISCH is a new innovation and entrepreneurial platform for the 'Flemish Chemicals using industries'. The leading actor in the development of FISCH was *essencia Flanders*, the multi-sector business federation of the life sciences and chemical companies in Flanders, in cooperation with VITO, the public research institute for environment, energy and materials. It has taken the lead in realising a transition to preserve the competitiveness of the chemical sector, recognising that: *i)* the business models need to be closer attached to the needs of society as providers of solutions; and that *ii)* the joint research and innovation efforts of academia, industry and society have to be increased and accelerated in targeted domains.

Key features of the cluster

Key assets that (can) drive entrepreneurial discovery

Key assets in the eco-system is the large chemical sector in Flanders which shows a growing capability of self-organisation, notably via the sector-federation Essenscia. The chemicals cluster in the port of Antwerp is the largest in Europe. In 2011, the chemical and life sciences industry generated a turnover of EUR 40 billion, which is roughly a quarter of the total turnover generated by the manufacturing industry in the region, twice the European average. The chemical and life sciences industry's trade surplus has more than doubled in the last 10 years and underlines the health of this industry in Flanders. Several leading chemical companies are longstanding investors in the region and continue to upgrade and extend their facilities. Next to big companies, the sector has a broad network of SMEs. All in all, the sector invests yearly EUR 1 billion in assets in Flanders. Moreover it is the largest private investor in R&D. In 2011, the chemical and life sciences industry spent over 1.5 billion on R&D.[30] Industry spending on sustainable chemistry is increasing.

Due to the self-organisation, FISCH has gained critical mass in joint projects, strategic process, plans and lobby. The Flemish government has endorsed the development of this cluster by investments that should lead to increased strategic decision-making and connect the cluster to the existing knowledge base in Flanders. FISCH is now granted the status of "competence pole" and accordingly receives a budget for strategic exercises and conducting R&D projects. By these means, FISCH and its members will conduct a number of road mapping exercises, which will be crucial in shaping the entrepreneurial process, as well as a range of R&D and demonstration projects.

In addition to the large industry, the competence pole FISCH, Flanders also has a number of research institutes and universities that work in this field. Most notable are the University of Gent with a strong group in the biotech sector, as well as the strategic research centre VITO, that conducts sustainable technology research of many kinds. Nevertheless, the quality and quantity of the research at the Flemish universities and research institutes is probably not yet high enough to meet the needs of the envisaged transformation of a world-class industrial cluster. A recent study by ECOOM – developed as a baseline study for OECD TIP S3 – shows that although the chemical sector is a top sector in economic terms, the scientific base in Flanders and even Belgium is weaker, as the publication outputs in this domain are below the benchmark average. Moreover, the alignment of the knowledge base in Flanders is not too high and may be better geared towards sustainable chemistry.

Other assets of the cluster include the harbour of Antwerp, which is of high logistical and geographical importance, the central position in Europe and the EU, as well as a highly skilled labour force. The external connectivity of the cluster is relatively high, for a number of reasons. First of all, quite a number of FISCH members are multinationals that are highly networked by default. Furthermore, FISCH and its member are strongly engaged in a number of networks, such as the European SUSCHEM network. Nevertheless, the engagement of FISCH at the interregional and EU level is an issue that is currently a focal point. All in all, this led to the following SWOT of FISCH and its eco-system, taking into account the following determinants of smart specialisation: anchors, connectivity, discovery and governance (see Figure 2.1).

Figure 2.1. SWOT of FISCH

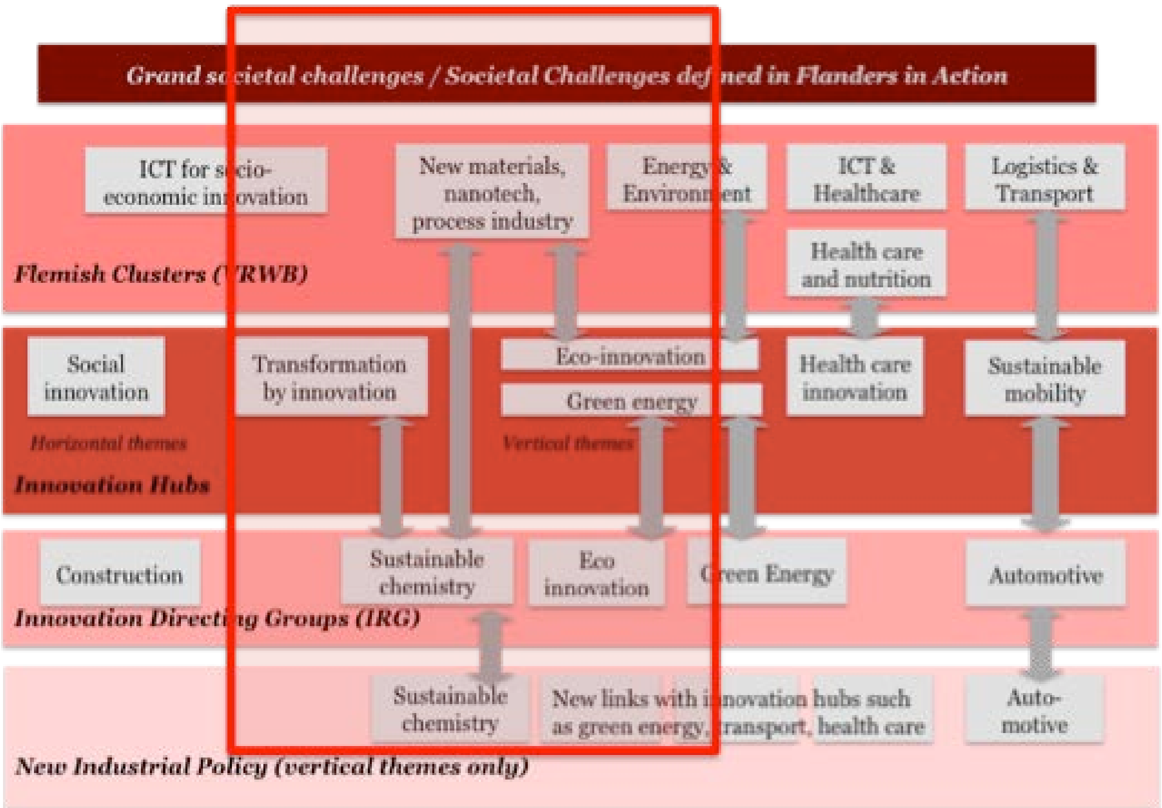
Strengths	*Anchors*	Broad involvement – of many stakeholders High private expenditures on R&D Many 'soft' innovation anchors (training, skills etc.) Commitment to sustainability	Weakness	*Anchors*	Realisation of all projects of FISCH do not necessarily lead to a sustainable transition High R&D-expenditures; but strong focus on pharma and life sciences Education not favourable for a blooming chemical sector
	Connectivity	Prime mover: essenscia Systemic view (value chains) Strong linkages with biotech		*Connectivity*	Systemic changes are depending on HQ-policies of key multinational partners
	Discovery process	Close to business Development of open innovation centres		*Discovery process*	Chemical value chains are highly integrated: barrier to change, lock-in Spill-overs yet low
	Governance	Commitment of Flemish government in the frame of smart specialisation & competence pole		*Governance*	Low public R&D exp. in chemical sector given the importance of the sector
Opportunities	*Anchors*	Developing white biotechnology knowledge base, based on strong basic knowledge in green and red biotech Sustainability driver offers (long term) market perspective	**Threats**	*Anchors*	Projects are strongly focused on solutions for key partners: threat is that spill-overs will be limited Rather narrow (public) knowledge base in Flanders (e.g. process technology)
	Connectivity	Further development of international knowledge links Collectiveness as goal in the mission		*Connectivity*	Development of other regions in similar sectors/specialisation profiles.
	Discovery process	Strong knowledge base for basic chemistry and petrochemicals in most neighbouring regions/countries		*Discovery process*	Economic crises, etc. Lock-ins due to longstanding contracts in the chemical sector
	Governance	Co-operations with other policy entities (e.g. Wallonia, Nl, EU, etc.)		*Governance*	Economic situations, political crises etc. Multi-layered governance changes and issues Horizontal policy integration issues

Source: Technopolis

Regional, national and international policies that have been decisive for prioritisation of domains

Relevant policy-making for smart specialisation is divided between two ministerial portfolios: *Economy policy* and *Science, Technology and Innovation (STI)* policy. The topic of FISCH, sustainable chemistry, does fit Flanders' prioritisation policies very well. FISCH targets the societal challenge of the "greening of society", which is an issue in all major policy and policy-advising initiatives. In the framework of the overarching policy in Flanders (Flanders in Action), FISCH targets the priority of transformation of existing industries by innovation and may play an important role for eco-innovation and more sustainable energy. In fact, FISCH is the first industry-led innovation hub; it is mentioned as a lead example in the Whitepaper on New Industrial Policy (economy policy) and thus is a tangible intersection between the innovation policy and the economy policy. Figure 2.2 shows the priorities of all relevant policy initiatives since 2007 – the box indicates the match with FISCH.

Figure 2.2. Societal challenges defined in Flanders in Action



Source: Technopolis

FISCH itself became a policy instrument during the course of the case study. It receives an annual pocket for financing of projects via the Innovation Agency IWT of about EUR 2.6m. In addition about EUR 0.8m may be dedicated to strategic exercises. FISCH will primarily use this for road mapping and project pooling and selection. Both these strategic exercises should be interpreted as entrepreneurial discovery processes that bring about further specialisation. Furthermore, FISCH applied for the status as official SUSCHEM platform; the European Technology Platform for Sustainable Chemistry.

Future development of the cluster: grasping the opportunities for smart specialisation

It is FISCH's ambition to further boost the transition towards sustainable chemistry by identifying and stimulating opportunities and by brokering and catalysing co-operation. Therefore, FISCH took a number of crucial steps which are laid down in FISCH' innovation agenda, its feasibility study and business plan. The Flanders strategic Innovation Agenda for sustainable chemistry was based on a wide variety of strategic exercises including: *i)* questionnaires and interviews of the most important stakeholders on the importance of these technologies for Flanders and for themselves, *ii)* technological workshops on selected topics; *iii)* SWOT analysis; *iv)* Road mapping; and *v)* Consultation-evaluation workshops with different stakeholder groups (large companies, small companies, societal stakeholders).

The further development of smart specialisation is characterised by the facilitation of a multi-actor entrepreneurial discovery process. This process will take place at three levels. First of all, FISCH is currently starting up its projects: FISCH members submit proposals for projects. This should be regarded as an articulation process of the industrial members of FISCH: the members identify promising routes for their work that are most relevant to their future. The FISCH office pools these articulations; it searches for complementarities between different players and topics, tries to forge bonds between the different actors and tries to establish platforms of these actors. This includes the search for matches with relevant players in the eco-system such as knowledge institutions.

Secondly, FISCH develops roadmaps for the selected topics in the Innovation Agenda. In addition to the shorter-term articulation of demands by members, FISCH develops roadmaps for the mid-term future. The roadmaps further indicate which steps should be taken within the framework of the Innovation Agenda. The roadmaps should allow for more strategic choices in the future and steering towards the pathway identified by selecting the most relevant projects. They also include an analysis of available literature, workshops and consensus building and matching between knowledge supplies and opportunities in the market.

Thirdly, within the context of this case study, a number of add-on exercises were developed that give further insight into the eco-system that surrounds FISCH. ECOOM developed a specialisation profile of Flanders. The outcomes of this exercise showed that while Flanders' economy shows a clear specialisation in chemistry, the technological and scientific specialisation level is much lower: the patenting and publication activity in Flanders is not much above the average level of all OECD benchmark countries. These points towards a current mismatch in the chemical domain in Flanders: the Flemish strength in the chemical domain is not backed by a strong R&D system in this domain. Furthermore, ECOOM analysed the technological strengths in the sustainable chemistry domain identified by FISCH and made a regional comparison of the patenting activity at NUTS2 level. The snapshot gave a similar image: while several other regions have a recurring strength in the domains of FISCH, Flanders does not appear in the Top-5's. This means that FISCH needs to find niches within these domains to excel closely linked to its industry and the available knowledge and technology development in Flanders and beyond.

Bottlenecks and threats for the eco-system that may hamper the entrepreneurial process include the following: *i)* A lack of high-quality knowledge production in Flanders and a relative low engagement in EU projects; and *ii)* The high risk of lock-ins due to the inertia of the chemical sectors innovation system: it features strongly integrated and complex value chains, which bring along long-term (supplier) contracts and obligations. One of the major challenges in this case is that the cluster has a strong economic position, but in terms of science and technology the international position of Flanders is weak and fragmented, resulting into a mismatch between the economic and scientific strength of Flanders in this domain. Most of the private sector R&D is conducted by companies with decision centres outside Flanders and in terms of academic research there are some small pockets of mostly basic research at various universities but no critical mass. This poses a policy dilemma when choosing for areas with future growth potential: how can policy initiatives provide a sufficient boost in the research and innovation and trigger matching private funds needed for the transition process towards sustainable chemistry?

Lessons earned and conclusions for policy

- *Prime mover:* the FISCH case demonstrated the crucial role of a prime mover in pushing the agenda for transformation and innovation. The entrepreneurial discovery process starts from a collective of actors (FISCH members) who jointly decided that entering new paths could form an opportunity for competitiveness and knowledge creation in the future. The government role in this case is one of facilitator rather than instigator of a new emerging domain.

- *Broad consultation and stakeholder involvement:* have been crucial elements in the development of the strategy process. FISCH is dependent on the support and dedication of a broad set of industrial and research actors organised in essencia, and tries to establish links within the eco-system, for instance to academia. Several rounds of workshops, surveys, conferences, etc. were pivotal in establishing a shared Strategic Research Agenda. This type of exercises will remain as important for the future entrepreneurial discovery process. The role of input from a wide set of stakeholders have enriched the strategies, and dedication of the FISCH members is simply necessary to fund the platform and projects. Again, the government role is one of a facilitator – and currently takes up this role by funding strategic exercises.

- *Research and economic mismatch:* the mismatch between the strengths in the economic system and strengths in the research system is a policy challenge. The answer found is often in a more 'bridging' type of an initiative as FISCH. However, it should be questioned whether the current mismatch between the economic strength and the rather average level of scientific and technological production can be addressed in relative short term.

- *Regional and international links:* the current funding for FISCH primarily allows for regional projects – policy support to development of international linkages could be highly valuable, especially to address the aforementioned mismatch between the quality of regional knowledge and know-how (science, technology), and the economic strength. In the multi-level governance the issue of linking the regional strengths with international opportunities and value chains may have an interregional character, as well as a European dimension. While FISCH tries to connect to the European Technology Platform, it could benefit strongly from policy support to further strengthen its linkages.

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30 Source: essenscia-survey amongst member companies.

NETHERLANDS, BRAINPORT EINDHOVEN: TOP TECHNOLOGY REGION SPREADING ITS WINGS

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Definition of the eco-system and its boundaries

Brainport Eindhoven Region is the industrial high-tech heart of the Netherlands, covering Eindhoven and 20 surrounding municipalities, and is part of the region SouthEast-Netherlands (ZON). The name Brainport dates back to the early 2000s and represents – besides a new brand name for the region - a well-coordinated and interlinked set of Triple Helix collaborative initiatives to strengthen the region's economic and innovation base. With a strong technology and design base, Brainport is one of three key pillars of the Dutch economy, together with Seaport (Port of Rotterdam) and Airport (Schiphol Amsterdam). Brainport belongs to a select group of high performing high-tech clusters in Europe. The region has a strong position in Key Enabling Technologies, notably nano-electronics, photonics, advanced materials and advanced manufacturing systems. Key focal sectors are High-tech Systems and Materials, Automotive, LifeTech & Health, Food & Technology, and Design. In 2011 more than 8.300 companies were active in these sectors, up from more than 5 400 in 2002, which comes down to a rise of over 50% in less than a decade. These sectors for a large part coincide with the nine national 'top sectors' – the main focal sectors in Dutch industrial and innovation policy. Main markets for Brainport companies include health, life tec, food, energy, smart mobility, logistics, and security.

Brainport has a population of about 740,000 people, a Gross Regional Product of EUR 27 bn and a total R&D investment of EUR 2.5 bn, of which more than 80 per cent private. Brainport accounts for about 40% of Dutch business R&D expenditure and is the region with the highest patent density in Europe. With Leuven and Aachen, Eindhoven constitutes the core of the European Top Technology Region ELAt. The TTR ELAt is a densely populated high-tech knowledge region with more than 10 universities and an annual R&D expenditure of EUR 4 bn.

Key features of the Brainport cluster/domain

Industrial activity in the region ranges from the manufacturing of complex machines and systems, high-end lithography machines for the semiconductor industry, embedded systems for automotive to advanced medical systems and design, with micro- and nano-electronics and mechatronics being key technologies. The region is home to a number of leading Original Equipment Manufacturers (OEMs) of which Philips, ASML, NXP, FEI, Océ (Canon) and DAF trucks are the most important. Other bigger players in the region include CCM, OTB Group Marel, Nunhems, VanDerLande Industries and VDL Groep. Defining characteristics of many of Brainport-based companies are a high R&D- and knowledge-intensity, a strong export orientation towards high-value added niche markets and a strong presence in global value chains. Apart from large OEMs, the region is characterized by a fine fabric of SMEs in close proximity, all on an area of 100 km2 by 100 km2. Many of these SMEs are part of the Brainport cluster, as prime suppliers to the OEMs. Part of the supplier network also extends to the corridor Eindhoven – Leuven; the value network includes a number of renowned universities (Eindhoven, Tilburg, Maastricht, and Leuven) and research institutes of which Holst Centre, Leuven-based IMEC, TNO and the Dutch Polymer Institute are prime examples.

Regional, national and international policies that have been decisive for prioritisation of domains

The governance of the innovation system

The innovation system of Brainport is to an important extent *'business-driven'*, powered by entrepreneurial leadership and strong collaboration between industry, knowledge institutes and government in the triple helix[31] and ample participative involvement of civic society. The tradition of entrepreneurial leadership and co-operation goes back a long time in history. Entrepreneurs such as the brothers Philips (Royal Philips, established 1891), Van Doorne (DAF, established 1928), Van Thiel (metal-/steel industry), and Father Van den Elsen (co-operative banking, nowadays Rabobank) laid the foundations for a strong industrial base. Relatively new OEMs such as AMSL, Océ, NXP and FEI are a continuation of this longer tradition. Many of today's initiatives and projects stem from and are led by private business. The R&D and innovation governance model explored by Brainport has certain unique features, characterized by successful public-private partnerships (e.g. Holst Centre), strong involvement of knowledge institutes in close proximity, open innovation (e.g. the former Philips High Tech Campus, nowadays High Tech Campus Eindhoven), multidisciplinarity and cross-overs between technology domains, low barriers and high trust. The role of government in the triple helix is relatively modest, yet important, as a funder of public R&D expenditure, public infrastructure and as a stimulator and co-ordinator.

Besides collaboration in the triple helix, the term governance also refers to how the national, the regional and the local governments co-operate and interact, and how Brainport connects to and collaborates with other regions (domestically and internationally). The public governance system in the Netherlands can be typified as multi-level governance, made up of the central government at national level ('Rijk'), the twelve provinces and the municipalities, and more recently also with a growing importance for the regions such as Brainport or Randstad. These regions are usually made up of several municipalities and tend to take various sizes, forms and ways of cooperation. The central government is responsible for education and science policy as well as the design, implementation and funding of most other policy domains. It provides most of the budget funding for the provinces and municipalities who both have - by law - only little tax raising powers. The majority of R&D and innovation policy instruments are determined at national level, even though the provinces and regions have some say, in particular in the design and implementation of regional development programmes and initiatives. The recent trend of decentralisation of government powers has resulted in a growing importance of the municipalities, especially in policy implementation (*e.g.* in social security and unemployment). Decentralisation has also increased the powers of the provinces, most importantly in regional-economic policy, nature management and spatial planning.

Priority setting in the governance system

Although the innovation system in the Brainport region can be characterized as business-led and informal, formal governance structures matter. This not only applies to the province North-Brabant and the municipalities making up Brainport, in their coordinating and stimulating capacity, but more in particular to the pivotal role of the regional development agencies BOM (the provincial 'agency' in regional innovation and competitiveness programming) and Brainport Development. The existing regional strategies and programmes can best be seen as 'pacts' signed by public-private, triple helix-like partnerships involving a broad range of actors. With the regional government having limited budget and autonomy, bottom-up initiatives and collaboration are vital.

Brainport Development is a new style development agency in which large companies and SMEs, knowledge institutes and governments at various levels collaborate. Its management approach is to bring stakeholders together, acting as a catalyst and stimulator, in a project-based manner, and to shape initiatives in such a way that they can sustain themselves, borne and backed by the stakeholders involved rather than by Brainport. Under the header of Brainport independent cooperatives have been established, among which Brainport Industries (a network of 150 suppliers set up to strengthen collaboration in the chain), Capital D (design) en Brainport Health Innovation are important examples.

In 2010 Brainport developed, on request of the central government and parallel to the already existing airport and seaport visions, a cohesive and comprehensive future vision. *Brainport 2020, Top Economy and Smart Society* is an ambitious regional vision, strategy and implementation programme for the oncoming years. Brainport 2020 was produced by a triple-helix programme committee, in close bottom-up consultation with regional stakeholders. The ambition is to be among the top three top technology regions in Europe and in the top ten worldwide by 2020. One of the central elements of Brainport 2020 is to build and strengthen the cross-border links with Flanders and Nordrhein-Westfalen in the TTR Eindhoven-Leuven-Aachen. Another main challenge is increasing public investment in the Brainport region. This especially applies to boosting public R&D expenditure.

Key policy instruments and investments

The most important innovation policy instrument, both in funding size and in popularity, is the national *WBSO scheme* for corporate tax deduction of R&D expenditures. Specific regional innovation policy instruments include the *Operational Programme South Netherlands* ('OP-South' 2007-2013, EU-co-financed) covering the NUTS2-regions North Brabant, Limburg and Zeeland. The OP-South is still running, while two other regionally focused policy instruments, '*Dynamic Brabant'* (2008-2011) being the provincial programme for innovation and competitiveness, and the national instrument *'Peaks in the Delta Southeast'* (PiD) for regional innovation covering the Brainport region (2006-2010) have both ended. The decision at national level to stop regional development support by abolishing the 'Peaks in the Delta' (PiD)-programme brings important challenges for the funding (matching) and the scope of future activities, which not only affect regional development programmes, but also the regional development agencies such as the BOM in North-Brabant and LIOF in Limburg.

As from February 2011, *Dutch national industrial and innovation policy* has gradually been reformed from a 'key area' ('*sleutelgebieden*') into a 'top sector' ('*topsectoren*') policy; nine top sectors have been selected including High Tech Systems and Materials; Life Sciences and Health; Logistics; Chemicals; and Creative Industry. The policy reform included a decisive shift from subsidy-led policy to tax-based R&D and innovation policy. The popular WBSO scheme has been extended and a new SME fund *MKB+* established, inter alia. During 2011 bottom-up visions and strategies for the nine top sectors were produced by triple helix 'top teams', each chaired by a leading industry figure. As a follow-up *TKI*, 'Top consortia for Knowledge and Innovation', were set up. For each of the top sectors binding Innovation Contracts were concluded between industry, knowledge institutes and government. The current top sector policy focuses on sectors irrespective of their location, unlike the former 'Peaks in the Delta' programme which had a regional innovation focus.

Coordination activities to support smart specialisation

With the 2011 industrial and innovation policy reform, Innovation Contracts will set the scene at the national level in the oncoming years. One of the challenges is to align these national top sector implementation programmes with the regional innovation strategies for Smart Specialisation which is in the heart of the new Structural Funds programming period 2014-2020. In terms of vision and ambition *Brainport 2020* sets the stage for smart development of the region. Critical in programming will be the national willingness and ability to (co)finance. *Brainport 2020* has been designed as a Smart Specialisation Strategy, with open innovation, focus and triple helix collaboration as its keywords.

Measuring the effects and impacts

Brainport 2020 contains an ambitious list of 70 actions together with their intended results and outcomes by 2015 and 2020, framed in terms of measurable and accountable indicators. This also holds for its urgency programme 2011-2015. For a number of base line indicators have been determined. The same holds for the national top sectors with clear and accountable measurement frameworks being set up by Statistics Netherlands and Agency NL. Monitoring is done on an annual basis in the *Brainport monitor*, covering 40 statistical indicators on people, technology, business and basics. The Brainport monitor contains trend analysis and benchmarking, inter alia comparisons with national average and, where possible, other European Innovation Regions (e.g. Regional Innovation Scoreboard top 20).

The monitor also includes an analysis of about 30 reports with qualitative and quantitative analyses on Brainport relevant topics like global location trends, raw materials, talent etc. Monitoring is sometimes followed by evaluation. In the past most regional development programmes, including 'Peaks in the Delta' and 'OP-South' have been evaluated. The performance of Brainport is also evaluated by others. In 2011 the region was awarded the title "world's most intelligent community" by the Intelligent Community Forum (ICF) representing "a model for a new way of thinking about cooperation and regional development". In 2010 the region won the Eurocities award for cooperation between companies, knowledge institutions and government. The Brainport region stands out in terms of international connectedness, collaboration and entrepreneurship, but also in terms of R&D and innovation performance as measured by patents and business R&D expenditure.

Future development of the cluster: grasping the opportunities for smart specialisation

Challenges and opportunities

Brainport 2020 identifies three 'top clusters' and a number of 'clusters in development': *i)* The top clusters are high tech systems, chemical engineering & chemistry, and *lifetec* (medical technology and cardiovascular); and *ii)* Clusters in development find their base in the three top clusters and include smart mobility, smart materials and smart *homecare* (non-clinical care).

Diversification through cross-fertilization ('cross-overs') and up scaling of new and existing clusters are a key ingredient of the Brainport strategy. How diversification and cluster development is taken at hand is shown by the example of the lifetech & health cluster, with *Brainport Health Innovation* (BHI) and, based on BHI, *Smarter Life 2020* as leading initiatives. BHI focused on innovative solutions in healthcare, with an emphasis on dementia, diabetes, COPD and cardiac failure. In the recently established *Smarter Life 2020* ('Slimmer Leven 2020') health and homecare institutes, companies, knowledge institutes and government jointly collaborate to bring innovative solutions nearer. Solutions in healthcare require more than only technological solutions. This applies to room for testing and experimenting ('*proeftuinen*') with new models, for example, by more focus and emphasis on prevention in healthcare, as well as changing existing incentive and remuneration models (result- or performance-based rather than treatment-based).

An important challenge is to overcome existing barriers to really innovate, both in the sector itself and in politics, with healthcare reform being a highly sensitive issue. The fragmentation of the European healthcare market also acts as a major barrier to innovation. The predominance of national markets and nationally organised healthcare systems makes it hard to define lead market and innovative procurement initiatives of sufficient size and scope. Fragmentation also prevents European lifetech companies from taking the advantages of a large European home market and limits their ability to effectively scale up their operations vis-à-vis competitors. In overcoming this fragmentation, the European Union could play an even more active and leading role, in financing pilot projects and in setting up structures that enable cross-border cooperation.

The multi-level governance of initiatives like *Smarter life 2020* is not obvious. Activities of *Smarter Life 2020* are related to two top sectors, have a strong link with the region because of testing and experimenting, involve national legislation but also different regional organisational structures.

Diversification through cross-fertilization goes hand in hand with the need for scaling up existing and especially new Brainport clusters. Scaling up implies looking beyond borders, in the ELAt area but also further beyond. The corridor Eindhoven-Leuven is performing well in terms of cross-border collaboration, especially in R&D and innovation, with IMEC and Holst Centre as best practice examples. The ICT Labs and InnoEnergy KIC's (Knowledge and Innovation Communities) established end 2009 by the European Institute of Innovation and Technology, with both a co-location in Eindhoven, are other examples. The challenge ahead is to improve cross-border collaboration at the level of high-tech starters and SMEs. The experience of DSP Valley (a Flemish-Dutch technology network organization focusing on design of hardware and embedded software technology) shows that collaboration is possible and might also be taken up fruitfully in other clusters. Further intensified collaboration in the ELAt, in particular strengthening ties with the Aachen region, could also offer opportunities in further scaling up. Aachen is largely complementary from a specialisation point of view, with a strong public R&D and university cluster. With the launch of the 2010 joint action programme, ELAt is set up as a regional initiative carried out by regional partners, based on concrete cross-border projects.

Although national funding for such projects in the past proved very difficult, European funding opportunities based on Smart Specialisation offer new scope for intensifying cross-border collaboration further. The Lifetec and Health cluster is also in this respect a good example. Scaling up en cooperating cross-border and internationally is crucial to be successful. *Smarter living 2020* participates in several European projects. The INTERREG project RECAP serves an example. RECAP is a health portal and platform in which three regional hubs (Aachen, Leuven and Maastricht) collaborate to test specific technological applications for cardiovascular treatments. This project is part of the set of activities to realize (together with Flanders and South-Holland) a Knowledge and Innovation Community (KIC) on Healthy aging as part of the European Institute of Technology and Innovation (EIT).

Cross-border collaboration can also offer solutions to one of the major challenges in scaling up, talent and skilled labour. Skills shortages and gaps are most urgent in the medium and higher skilled segments of technicians and engineers. With low unemployment even in the current crisis, a relatively large group of baby boomers retiring and a limited mobility/willingness to travel, shortages are expected to sharpen in the future. This may lead firms to strategically outsource certain functions in the value chain, a trend that is already visible. But it may also pay off for the ELAt region as a whole to pool available labour resources, lower existing barriers and stimulate cross-border mobility.

A challenge in view of smart specialisation regional programming is the (so far non-resolved) lack of national public matching funds, also for cross-border collaboration. With the 2011 top sector policy reform, tax instruments and risk financing (credit, venture capital) have replaced existing subsidy instruments. Moreover, in the runner-up to the new programming period 2014-2020 current available funding for regional projects is almost zero, as earlier nationally-funded regional programmes such as *Peaks in the Delta* have been discontinued as a result of the policy reform. With a new provincial programme in the making and the funding capacity of the on-going OP-South 2007-2013 almost entirely used, the current situation is less than optimal. The general perception in the region is that the former *Peaks in the Delta* programme has been a successful and highly conducive format for regional development, with its low barriers to entry, bottom-up nature, its targeted call for tender structure along the lines of valorisation, knowledge generation and its appropriate quality assurance and evaluation.

Lessons learned and conclusions for policy

The lessons learned can be grouped as follows:

What S3 can learn from Brainport Eindhoven?

- *Business-driven innovation system:* with a largely business-driven innovation system embedded in a well-organized, modern and conducive triple helix structure since 2000, the Brainport Eindhoven case offers a number of lessons for designing and implementing Smart Specialisation strategies for a functional (e.g. non-administrative) region.

- *Effective collaboration in the triple helix:* whereas 'entrepreneurial discovery' is engrained in and at the roots of the Brainport model, its project-based new style development agency Brainport Development shows that effective collaboration in the triple helix can deliver new initiatives and help speed up (new) cluster development on the edges of existing sectors, who cannot be identified by macro-statistics. The Brainport Eindhoven experience, however, also shows that successful S3 implementation requires endurance and patience at the different governance levels; as a rough rule of thumb new 'grand' initiatives need 7 to 10 years to mature.

What Brainport Eindhoven can learn from Smart Specialisation?

- *Cross-borders opportunities:* new smart specialisation programming offers a number of advantages for Brainport Eindhoven, of which the opportunities to extend and strengthen cross-border collaboration in the wider ELAt region are perhaps the most eminent. To successfully enhance further cross-border collaboration more is required than a smart cross-border regional strategy and pro-active regional governments.

- *Partnerships*: Vital is that industrial partners, and especially large leading companies (OEMs), see the need and benefits of cooperation on the ELAt scale and are willing to invest in and deepen their ties with the region, supported by research institutes and universities and in broader interaction with civil society.

- *Future challenges:* Brainport 2020 is in many respects a success example of an Smart Specialisation exercise. Further improvements in a future vision and strategy process refer to the introduction of peer reviews and a more deliberate use of foresight and scenario planning, not least since high-tech regions like Brainport are operating in highly dynamic and unpredictable markets subject to globalisation and strong international competition. One of the challenges ahead is to translate the Brainport 2020 vision and strategy into a coherent policy mix in which the new Operational Programme South 2014-2020, the new regional programmes of the province Brabant and Limburg and the national top sector visions and roadmaps are aligned to a *coherent* S3 strategy for the oncoming years – closely connected and attuned to neighbouring regions in the ELAt-region.

NOTES

31 With open innovation in the core of Brainport's development strategy - along with new forms of participation-, the Eindhoven triple helix model has actually transgressed towards a *quadruple helix* structure in which innovation users, most importantly B2B, are already part and parcel of the Brainport model.

GWANGJU, KOREA: PHOTONICS CLUSTER

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Definition of the eco-system and its boundaries

The Gwangju photonics cluster is an agglomeration of the photonics industry with strong policy intervention to establish and attract universities, research institutes and service agencies. Four local universities or their affiliated campuses, nine research institutes/local branches of government research institutes and seven public service agencies are the driving forces to induce and promote local photonics industrial cluster. These various stakeholders establish the key assets in the eco-system that drive entrepreneurial discovery inside and outside of the cluster. There are seven service agencies that support the meta-network of the cluster that enables connectivity at the firm and industry levels. The local networks provide business incubation, research and technology development, pilot production and equipment services, management and marketing services, human resource development and technology transfer. Neighbouring research institutes also provide support to research and technology development, education and human resource development, business incubation and promotion. Many companies now in the cluster migrated from other parts of the country to take advantage of policies, funding and proximity to other industrial agents.

To foster the regional eco-system, external connectivity is promoted through the strengths that exist within the eco-system. Knowledge flows between researchers inside and outside the cluster ensure that research is kept at the forefront of technology innovation with competitive firms in LED and optical communication placed within the global supply chain. The current status of the cluster has been developed strategically in the past, enabling it to function well today between academia, government and industry. The knowledge base that is created within this network provides the platform for future specialisation by firms.

Key features of the cluster/domain

The birth of the Gwangju Photonics Cluster traces back to the Asian financial crisis in late 1997, which hit Gwangju particularly hard when the local company Asia Motors went bankrupt. The crisis drove local stakeholders to reach a consensus to establish a new local economic development plan and strategies. The main stimuli of related industry growth were local strategic industry promotion programmes of the central government and establishment of related institutes in the region since the late 1990s. These technology infrastructure and programmes served as a refuge for domestic photonics producers during the early 21st century global photonics industry downturn. The most important was to establish photonics industry research and promotion institutes and technology extension centres. The central government's strategic industry promotion programmes were also utilized for local industrial planning exercises, technology development grants, networking, etc. Since the inauguration of the photonics industry promotion in Gwangju, the average annual growth rate of production, number of employees and companies are 19.2%, 9.6% and 5.0% respectively. Production volume reached KRW 2 540 billion in 2010. The number of employees has also jumped to 8 270 at 377 companies in 2010.

Regional and national policies that have been decisive for prioritisation of domains

Government action has been decisive for prioritisation of industrial domains. This was accomplished through governance structures including priority setting, policy instruments, funding and coordination bodies. Through active engagement with the innovation system, government has been able to successfully develop Korean photonics industry in Gwangju. Various ministries have developed and managed regional programs since the mid-1990s when local elections started. Ministries financially supported technological infrastructure and regional institutions and provided support to local actors including universities, research institutes and firms. They also created several central agencies. The Presidential Committee on Regional Development was created to resolve coordination issues arising out of the proliferation of regional ministerial programmes and between central and local governments. Most of the research institutes, agencies and technology centres promoting the photonics industry in Gwangju were established through the Ministry of Knowledge Economy programmes because it focuses on technology development and commercialisation. Currently, Gwangju cooperates with the neighbouring provinces of Jeonnam and Jeonbuk as part of central government's Leading Industry Promotion program.

The local policymakers also set priorities for the governance system to support photonics, specifically optical communications and LED technology. Within the optics sector, specific programmes were targeted based on market attractiveness and feasibility, which considered local technological capabilities, human resources among other characteristics. The LED sector focused on domestic demand because various sectors such as automotive and handheld devices have great potential for market expansion and local suppliers already have certain capacities and contract relationships.

Korea has supported the photonics industry in three consecutive phases from 2000 through 2012. Each phase supported different priorities in combination with technology infrastructure, technology development and extension. The initial stage focused on building technology infrastructure to promote industry through pilot production and research equipment/facility support. These were embodied in the Korea Photonics Technology Institute that provided a test system of photonics communication and leadership in optical communication and materials. In the second phase, a full-fledged service system was designed to promote the two priority areas of optical communication and LED. These areas extended infrastructure support to semiconductor light sources, optical precision and measurement that included technology centres for semiconductor light source pilot production, optical parts subsystem and reliability and accreditation testing infrastructure. The latest stage prioritized the enhancement of local industry technology capabilities to help commercialize fusion and convergence photonics.

When photonics promotion began, research institutes with core R&D capacities and expensive common equipment were crucial in order to reach minimum critical mass in the region. Their technological and human capacities can be utilized to provide technology development, extension services and testing and accreditation services locally. The foundation of future development of local clusters, the regional network of industry, universities and research institutes emerged through project implementation. At the regional, national and international levels, issues were found for cluster promotion such as intensifying networks and financing of commercial activities and product development.

Future development of the cluster: grasping the opportunities for smart specialisation

Just as the past development of the photonics cluster was dependent on government intervention, prospects for future development are dependent on grasping opportunities for smart specialisation. The vision to make Gwangju a global top three cluster is laid out in Photonics 2020: New Vision for Photonics Industrial Development. There are three development goals in the Vision that seek: *i)* to develop photonics R&D cluster; *ii)* to attract Korean large companies, boost SMEs and attract FDI; and *iii)* to strengthen supply chains to increase demand, localize production of intermediate goods and internationalize R&D cooperation and marketing. To accomplish such goals, strategies will: *i)* promote next generation innovation and enhance global standard leadership; *ii)* focus on fusion technologies; and *iii)* intensify business services by capacity building and better coordination of service agencies.

When planning how to further develop, policymakers must take into account competitive advantages like strong engineering capabilities, general purpose technologies for next generation products and diverse engineering extension networks in place. These local networks include product development, testing and pilot production. These networks need to expand and diversify beyond the current proficiencies in LED and optical communication technologies. At the national level greater streamlining and coordination of institutions as well as capacity strengthening are needed.

Nonetheless, there are bottlenecks and threats that can hamper entrepreneurial discovery in the ecosystem, especially in an increasingly competitive global market. The key challenge is to improve differentiation in emerging technologies that serve as new fusion industries. Factors that contribute to these difficulties are shrinking domestic demand and weak local linkages. Further, local industry finds itself constrained by its small-firm size and low levels of technology; only one firm, LG Innotek, is a large company. In the past, the central government was able to act in a leading role by establishing public institutes to promote photonics in Gwangju. This led to the successful creation of a minimum critical mass and a virtuous circle of continuous development. To facilitate this process, bottom-up decision making needs to be strengthened and sustained policies can become decisive drivers for the ecosystem in the future as in the past.

Lessons learned and conclusions for policy

The lessons learned can be grouped as follows:

- *Cross-sectoral linkages*: Local industrial structure analysis shows Gwangju lacks future core industries. Therefore, in order to prepare for the future, Gwangju has begun to promote three other regional strategic industries: digital information appliances, automotive and advanced parts, and design.

- *Multi-level coordination and mobilisation of stakeholders*: Photonics was the first industry promoted by the central and local governments and has strong potential to diversify and modernize local industry. To achieve this strategic transition of local industrial structure, it is necessary to reposition the local photonics industry in the global production network to mobilise global resources and to develop next generation products. It is also necessary to create a multi-level governing mechanism to coordinate stakeholders and a consensus development process.

- *The role of smart specialisation*: The smart specialisation concept and strategies may help local authorities to find appropriate approaches and tools for practical solutions as they are confronted with the urgent necessity to prepare R&D programmes and governing mechanisms adapted to the local context of industrial transformation.

- *Photonics sensing technology*: one of the next three target technologies of Gwangju, can upgrade technological competitiveness of these strategic industries and help their modernisation.

ANDALUSIA, SPAIN: THE ANDALUSIAN AEROSPACE CLUSTER

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Definition of the eco-system and its boundaries

Innovation Infrastructure

The aeronautic activity in Andalusia dates back from 1926 and has been historically related to Defence products. The former Spanish aircraft maker CASA had established four manufacturing plants; these four plants (today Airbus) form the cluster Nucleus. Its significant growth can be traced back to the late 1980's with the development of a nurtured network of subcontractors, the cluster Auxiliaries. The cluster is formed by 80 SMEs and 40 non SMEs that employ approximately 11 000 people. The cluster´s turnover is approximately EUR 2 billion, which accounts for 35% of the industrial GDP of the provinces of Seville and Cádiz, the home of the cluster. The Regional Administration has created the innovation infrastructure to empower capabilities in aeronautics: *i)* CATEC: the Advanced Centre for Aerospace Technologies is specialised in three areas: unmanned vehicles and robotics, simulation and systems, and structural testing and materials; *ii)* SEILAF: an advanced system for simulating forest-fire fighting. The system, aside from providing realistic firefighting training time for fire brigades including a full motion helicopter simulator, will improve current guidelines and strategies for forest-fire fighting; *iii)* ATLAS: a test bench for Unmanned Aerial Vehicles designers and manufacturers: segregated aerial space to conduct flight tests. hangars, 800 m runway, offices, workshops, etc.; and *iv)* AEROPOLIS and TECNOBAHÍA: two Scientific and Technological Parks assigned to the domain of aeronautics, including incubators, Engineering centre, Suppliers Village among other services.

The knowledge base stems from the School of Aeronautic Engineers and the rest of applied studies from the Universities of Seville, Pablo de Olavide, Cádiz and Córdoba. There are nonetheless several other Technological Centres available for the cluster: AICIA (Association of the Seville University School of Engineers), Andalusian Institute of Technology (IAT, regarded as a centre for knowledge management), CITIC (Innovation Centre for ICTs), FAICO (Centre for image and colour). Aeronautics in Andalusia is a sector with a high degree of international linkages. Companies in Andalusia are part of the European Aeronautic Supply Chain, with an export rate of 70% of its turnover. There are also strong ties with Brazil, Canada and USA. The cluster organisation Hélice is a founding member of the EACP consortium (European Aerospace Clusters Partnership). The region has participated in three important long term aircraft programmes: A400M, A380 and A350, as well as in traditional Spanish production of CN235 and C295. Likewise, Andalusia has a long experience in mobilising institutional resources to meet the sector's requirements. Innovation and Development Agency of Andalusia (IDEA Agency), the Technological Corporation of Andalusia (CTA), the Aerospace Technology Institute (INTA), the Andalusian Institute of Technology (IAT) and the Andalusian Universities of Seville and Cádiz, are among the most proactive institutions in supporting the cluster. Important Strategic developments regarding Human Resources are the creation of the School of Aeronautic Engineers, school of Aircraft Maintenance Technicians and blue-collar yearly training programmes, in order to provide a steady flow of trained people for the cluster´s growing needs. The Auxiliaries are nonetheless too small to the new standards set by Airbus for bidding purposes, and mergers and joint ventures have not yet attained the local entrepreneurial culture

Key features of the cluster/domain

The Hélice Foundation participates in national and international forums, conveying the voice of the Andalusian cluster. The Foundation has promoted creation of a cluster committee within the Spanish national association of aerospace and defence companies (TEDAE) and takes part in the European Aerospace Clusters Partnership (EACP). The Foundation participates in the European technology initiative called *BoostAero* that promotes creation of suppliers ITC portal for aerospace. It also participates in a national initiative to identify, initiate and provide financial help for the Spanish clusters (the AEI initiative of the Ministry of Industry).

The Foundation is active in: *i)* the dissemination process by publishing articles on the quarterly magazine Aeronautica Andaluza; *ii)* conducting survey studies to deepen the cluster's capacities and identify potential project opportunities; *iii)* organising and holding the Committee for Entrepreneurial Action (CEA), a meeting point where the companies reunite every six months, dealing with central issues concerning the cluster (*e.g.* its analysis, conclusions and requests constitute the blood and raw material for the Helice Foundation to set the sector's opinion and needs); and *iv)* providing advice to the Regional Administration to update its priorities and strategic lines of action. As an example, it produced the Strategic Plan base document around which Regional Administration, Entrepreneurial Associations and Trade Unions together negotiated and approved the strategic document.

Regional, national and international policies that have been decisive for prioritisation of domains

The innovation system in Andalusia evolves on the base of "Innovation Infrastructure": a network of "Knowledge Agents": public and private Technological Centres and Scientific and Technological Parks, Research and Technological Institutes. Knowledge generated is made available to enterprises through these Knowledge Agents that have to be approved by the Central Government, in order to validate their research structure before the enterprises cooperate with them to carry out R&D projects financed by the Ministry of Innovation. This way the regional innovation infrastructure is linked to the national R&D programmes and priorities.

Priority setting is defined by the Andalusian Plan for Research, Development and Innovation for 2007-2013 (PAIDI), the main tool for programming, coordinating, stimulating and assessing the Regional Government of Andalusia´s scientific and technological development policies. The industrial regional policy is defined horizontally by the Andalusian Plan for Industrial Development, which pinpoints the sectors to be considered as strategic. The Aerospace Plan 2010-2013 has been developed and agreed upon by the regional administration and the social agents with a technical advice and assessment of the Helice Foundation. To support the proposals and lines of the Aerospace Plan, several national and regional funds (mostly, but not exclusively ERDF) have been employed. The National Aerospace Strategic Plan was developed by CDTI before the Andalusian Plan and so its priorities and lines of support had been considered in order to align the regional plan with the national objectives.

The Technological Centres and Parks, like CATEC or *Aerópolis*, use the ERDF to fund their initiatives. Through this, CATEC has recently help to develop a simulator system. While *Aerópoli*s provided buildings to host engineering and start-ups, the Technological Centres contributed to general expenses. At the regional level, support is provide through grants, depending on the nature of the beneficiary entities: *i) Enterprises*, managed by the Development Agency IDEA, include several incentives lines: for creation, modernisation, co-operation and R&D projects with special consideration to strategic sector defined by the Industrial Andalusian Plan; and *ii) Agents of Knowledge*, supporting the researchers (individual or group) at the Technological Centres, Parks, Universities. IDEA Agency also manages a Financial Engineering Andalusian Funds, regionally funded, with a wide range of financial tools. Regional priorities are aligned with national ones and with European strategies. In the case of the PAIDI, for example, the Plan counts within the framework objectives of the Lisbon strategy and its later documents: The Renewed Lisbon Strategy. Likewise, at a national level, the Plan is included in both reference framework of the National Programme of Reforms and the objectives of the *Imagenio 2010* Programme. Finally, this Plan takes the programming documents of the National Strategic Reference Framework 2007-2013 into account, as well as the Strategy for the regional development of Andalusia, and the Andalusian Operational Programme 2007-2013 Regarding the mechanisms that exist at a regional level to assess, monitor and evaluate the strategies, this kind of analysis process can be found at the "Andalusian Competitiveness Strategy" document. This process takes place yearly when elaborating the Annual economic and financial reports. These reports provide the follow-up in order to reorient or modify, if necessary, the development or the goals established in the Plan.

Future development of the cluster: grasping the opportunities for smart specialisation

The Strategic Plan's main goal is "to turn the Andalusian Aerospace into a competitive sector of Knowledge & Innovation based economy and in one of the engines of development." This way the Plan aligns to the Andalusian Plan for Industrial Development (APID). This main goal is translated into specific Targets, amongst the most relevant: *i)* to set Andalusia as a world reference point for military transport and mission aircrafts; *ii)* to diversify and expand existing markets, increasing business volume with traditional aircraft makers, *iii)* to better institutional representation in the national decision bodies; *iv)* to impulse the design & development engineering for systems and mission equipment; *v)* to foster participation of Andalusian companies and institutions in national and international R&D cooperation programmes; and *vi)* to improve basic technologies utilized in the cluster. In order to achieve these goals, a set of 22 concrete measures were devised together with indicators to evaluate the Strategic Plan.

Lessons learned and conclusions for policy

The lessons learned can be summarised as follows:

- *Regional funds:* The important role of regional funds to promote the innovation infrastructure for aeronautics: CATEC as the Technology Centre and *Aeropolis* and *Tecnobahía* as Technology Parks.
- *Entrepreneurship:* Policy makers should take into account the entrepreneurial context of the sector when designing incentives.
- *University and industry linkages:* There is a clear need for promoting university research and university researchers within the entrepreneurial activities of the technological Parks and Centres. Importance to incorporate PhDs at the entrepreneurial and industrial level.
- *Better industry-public strategy support alignment:* There has been no formal agreement between the Regional Administration and the aerospace cluster on common strategies. Thus, one of the changes to implement S3 strategies in the next EU Framework Programme would be to attach the approved cluster strategies to the published lines of financial support in order to devote the available resources to the goals of the strategy. Finally, internal co-operation in public institutions between departments dealing with different aspects (strategy design, funding) is far from optimal.

EAST MARMARA, TURKEY: THE AUTOMOTIVE CLUSTER

Definition of the eco-system and its boundaries

The automotive sector has been the pioneering sector of the Turkish economy in terms of exports and R&DI capabilities. The Turkish automotive industry is mainly located in the East Marmara Region; comprising of the provinces of Bursa, Kocaeli and Sakarya. Producing circa 98% of the 1.6 million vehicles (2011 findings) produced in Turkey and providing employment opportunities for approximately 45 000 people, the region is the centre of the Turkish automotive industry. Inarguably the Cluster has already at its possession the much needed “critical mass” of companies. According to 2010 findings, there are 22 original equipment manufacturers and supplier companies of around 1100 in the Turkish automotive sector. East Marmara Region is home to 13 of those OEMs (one of every two we can say), and to more than 85% of all component manufacturers. The cluster is again home to 2 free zones, 3 techno-parks, together with over a number of 25 Organised Industrial Zones (OIZ), such as the Bursa OIZ, Gebze OIZ, the Arslanbey OIZ, the TAYSAD OIZ at Gebze, in which significant numbers of automotive sub-contractors operates close to the automotive OEMs.

The cluster has strong connections with various umbrella organizations of the automotive sector, such as Automotive Manufacturing Association, Association of Automotive Parts and Components Manufacturers, Automotive Distributors Association, Automotive Consumers Association etc. and research institutions such as, Istanbul Technical University, Uludağ University, Gebze Institute of Technology, TÜBİTAK Marmara Research Centre and Automotive Technology R&D Centre etc. Besides, and with public institutions such as Ministry of Science, Industry and Technology; TÜBİTAK Headquarters and Institutions; Small and Medium Size Enterprise Development Agency; Technology Development Foundation of Turkey etc.; lastly The Automotive Technology Platform (OTEP).

Key Features of the cluster/domain

The diversified network facilities are the main competitive advantages of the cluster together with*: i)* presence of scientific and technological infrastructure to work with and to assist the automotive industry; *ii)* presence of a well-educated workforce in various sub- and related sectors; and *iii)* its geographical proximity to European markets and to the largest consumer markets in Turkey. Furthermore a SWOT analysis has been conducted within the report of the Special Committee on Automotive Sector published by the Ministry of Development in 2007 in order to contribute to the elaboration of the Ninth Development Plan. In accordance with this analysis, the strengths and weaknesses of the current eco-system of the cluster have been identified as below:

Figure 2.3. SWOT of the Automotive Sector

Strengths	**Opportunities**
• Unsaturated Domestic Market • Compatibility with the EU Customs Union and the technical compliance • Geographical location (proximity to the EU markets and largest domestic markets) • High Innovation Capacity • Flexible production with competitive costs and risk sharing value chain • Sophisticated demand structure • Strong Position in International Trade • Competitive sub-contractors and suppliers • High standards of quality in production • Well-educated, young, dynamic and highly motivated qualified workforce • Flexible and long working hours • The high level of technical and commercial skills • Ability to adapt to changes, standards, production and global conjecture • The high level of "Know-How" of the suppliers due to foreign partnerships	• Increase in domestic demand • Newly emerging opportunities within the global markets and neighbouring countries (New Export Markets) • Relatively low costs compared to the EU • Joint projects that suppliers are involved at the very beginning; in design processes within the production chain • The on-going studies dedicated to ensure the compatibility with the EU Legislation
Weaknesses	**Threats**
• The lack/minority of firms with Co-Design capability and the low rates of domestic value added • The lack/minority of test centres • The high levels of motor vehicle taxes and also the high level of taxes on fuel products • The incompatibility of the legislation on motor vehicle taxes with the EU Legislation • Inconsistency of demand due to sudden and high increases in taxes rates • Non-competitive support legislation compared to competitor countries • Bureaucracy in foreign trade procedures • High costs of energy • Low quality in fuel products • Insufficient transportation infrastructure • The insufficient integration and synergy between OEMs and suppliers • Insufficient export support schemes • High interest rates and high input costs • Increase in costs that are not reflected to retail prices • Inadequacy of industrial design capabilities	• Second hand vehicle imports from the EU • Uncertainties in studies conducted in energy efficiency and environment legislation • Enormous increases in raw materials • Negative Impacts of Revaluation of TL on Exports • The rise of China, India and East-Europe countries in terms of low costs • Delay in capacity building and technological investment decisions

Source: TUBITAK

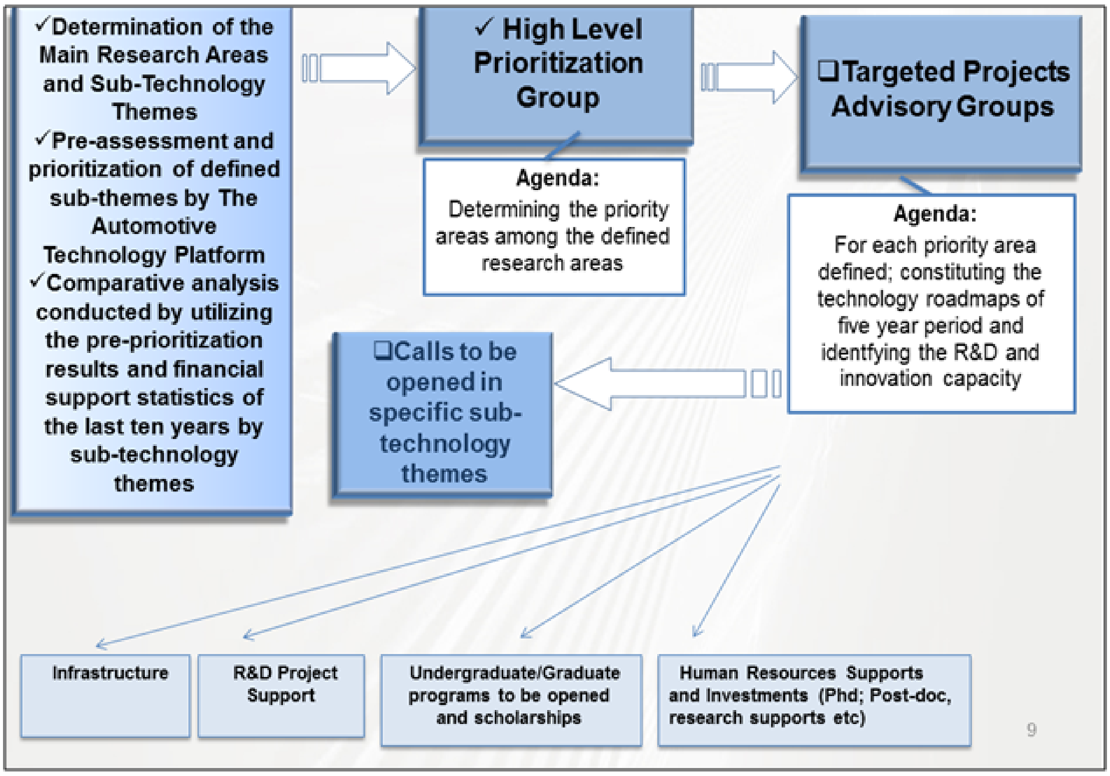
Regional, national and international policies that have been decisive for prioritisation of domains

The Supreme Council for Science and Technology (SCST) is the highest ranking STI policy-making body in Turkey. The Council meets two times annually. SCST is chaired by the Prime Minister and composed of permanent council members, which consist of the relevant Ministers and other top-level officials,[32] while other relevant stakeholders are invited to the meetings with advisory status. SCST is an asset for STI governance based on its role in establishing expectations that steer the Turkish system forward while guiding and framing policy intervention. SCST further assigns tasks to stakeholders for the implementation of the adopted decrees. As necessary, *ad hoc* committees have allowed stakeholders to identify specific problems and generate policy recommendations that feed-back into the policy-making process at the SCST level. Other assets for STI governance include various other committees and technology platforms involving SCST permanent members and/or stakeholders. The 24th meeting of SCST, for example, was realized on 7 August 2012; the main theme of which was "The role of education and human resources to reach national targets for the year 2023".

Priority Setting Method for the Automotive Sector

The automotive sector is one of eight sectors identified as priority areas in the recent STI Strategy document namely the National Science, Technology and Innovation Strategy (UBTYS) 2011-2016 in Turkey. The sector-oriented standpoint adopted within UBTYS 2011-2016 has been promoted by two results driven and targeted call based funding programmes which are designed by TUBITAK recently. Accordingly, temporary governance mechanisms have been established by TUBITAK in automotive and other priority areas which allow adapted environment for a bottom-up and an entrepreneurial discovery of the technology needs of each sector. These governance mechanisms are comprised of high level representatives from academia, private sector, and public sector. In the high level prioritization meetings of these actors, a consultative and a consensus building process takes place to designate R&D priorities in each sector. Calls are opened in each sector through the aforementioned funding programmes in the technology needs/topics that have been previously identified and prioritized at the high-level prioritization meetings. One can see the stages of the priority setting for the automotive sector coordinated by TÜBİTAK in Figure 2.4

Figure 2.4. Determining the Call Themes for the Targeted Sectoral Support Mechanisms



Source: TUBITAK

Future development of the cluster: grasping the opportunities for smart specialisation

There is a strong political commitment to support the automotive cluster among policy makers from different ministries and agencies that can be seen within the following instruments:

- "*National Science, Technology and Innovation Strategy (UBTYS) 2011-2016"* which has been prepared under the coordination of TUBİTAK approved by the Supreme Council of ST; in accordance with the analysis conducted considering the criteria of R&D Spending, FTE R&D Personnel, Foreign Trade Statistics; automotive sector has been identified as one of the sectors in which Turkey has strong R&D and innovation capacity and has to adopt targeted support mechanisms

- "*Industrial Strategy and Action Plan for Automotive Sector*" which has been prepared under the coordination of the Ministry of Science, Industry and Technology with contributions of the private sector and relevant public institutions and organizations; the main objective for the sector has been determined to "increase competitiveness". Other objectives are of ensuring technological deepening of the sector, increasing the added value in production and becoming the most competitive production and R&D centre in the region have been determined, based on an analysis of the current situation and SWOT analysis of the automotive industry.

- "*The Ninth Development Plan, Report of the Automotive Special Expertise Commission*" it is stated that "In the automotive industry, it is to be created an industrial structure; which produces high value-added, has sustainable competitiveness, targets exporting primarily to developed markets, and has a developed R&D capacity". There are also concrete targets related to the sector within the report for specific periods. It was foreseen to reach a total production of at least 1 million passenger cars with a total export potential valued at 14 billion dollars which has been realized in 2010. In 2011, the sector reached out a total number of 1. 6 million vehicles production and total exports valued at 13.8 billion (2010 findings). For the medium term a production target of 2 million has set with total exports of USD 25 billion at least.

Prepared under the coordination of the Ministry of Economy *Turkey's Export Strategy for 2023* aims at reaching a flexible and R&D based export structure; and also aims at reducing the import dependency of foreign trade in strategic sectors. Automotive is declared as one of those strategic sectors with a high dependency ratio on imports; in which urgent action and support are needed. There are also the studies and strategic reports of the Automotive Technology Platform (OTEP) to be mentioned on various sub-topics such as Mobility, Transportation and Infrastructure; Environment, Energy and Resources; Safety; Design and Production Systems; Electrical Vehicles Special Research; Nano-technology in Automotive; Electronics and Embedded Software etc.

Lessons learned and conclusions for policy

The lessons learned can be grouped as follows:

- *Strengthening R&D and innovation competences through the whole supply chain*: Turkey has fifty years of experience in automobile production, backed with a powerful supply industry and technological knowledge. In order to keep the automotive sector competitive, strengthening R&D and innovation competences through the whole supply chain should be ensured.

- *Strategic intelligence*: In line with this target, for future policies it is seen that strategic intelligence should be considered at utmost importance within the national innovation systems; and governance mechanisms should be arranged dynamic and long term oriented; rather than static and short-term. Accordingly, policy learning and an interactive point of view should be embedded within the whole cycle of policy making in order to achieve better governance and coordination between actors of the national innovation systems.

NOTES

32 The permanent council members of SCST consist of relevant Ministers (Ministers of the Ministries of Science, Industry and Technology, National Defense, Finance, National Education, Health, Food, Agriculture and Livestock, Forestry and Water Affairs, Customs and Trade as well as Energy and Natural Resources), Chairman of the Council of Higher Education, Undersecretaries of the Ministry of Development and the Ministry of Economy, Undersecretary of Treasury, Chairman of the Turkish Atomic Energy Authority, President of TÜBİTAK and a Vice President, General Director of the Turkish Radio and Television, Chairman of the Union of Chambers and Commodity Exchanges of Turkey, and a member to be appointed by a university to be designated by the Council of Higher Education. There are 21 permanent members, including the Prime Minister.

THE UNITED KINGDOM: THE UK AUTOMOTIVE INDUSTRY

Daniel Hodges, BIS, United Kingdom

The United Kingdom case study is a national-level study of how the automotive industry has approached a necessary transition to a low-carbon future. The need for transition was recognised by the government, who formed industry-led groups to devise a roadmap for transition. Whilst a smart specialisation approach was never specified, the processes used by these groups provide a strong example of such strategies being implemented.

The UK automotive industry

The UK automotive sector is characterised by significant foreign direct investment and high exports, equivalent to 12 per cent of the UK's exports of goods. Overall, automotive manufacturing provides 135,000 direct jobs and contributes some GBP 10 billion value-added to the United Kingdom economy. The United Kingdom produces over one million cars annually, and over two million engines. The United Kingdom is one of Europe's most diverse and productive automotive vehicle manufacturing locations and a global centre of excellence for engine development and production. More than 40 companies manufacture vehicles in the United Kingdom, ranging from global volume car makers, van, truck and bus builders, to specialist niche players. The industry is supported by a dynamic supply chain including many of the world's major component manufacturers, technology providers, design and engineering consultancies. The industry also benefits from a world-renowned knowledge base.

The industry spends over GBP 1.5billion annually on R&D in the United Kingdom and strategic government support for the transition to low carbon will continue to support over 700 000 jobs in the United Kingdom that rely on automotive manufacturing. There are around 2 400 component manufacturers in the United Kingdom, contributing up to GBP 5 billion added value and employing around 80 000 people. The components sector exports over GBP 6 billion worth of goods annually, 75% destined for Europe. The United Kingdom is an increasing force in powertrain design and production (the components making up the power transmission system of a motor vehicle from engine to final drive), with a particular strength in engines. A long established, independent design engineering sector offers the full spectrum of services from concept design through to limited-series vehicle production. The sector is recognised internationally for its flexibility and responsiveness and for the innovative qualities of its engineers. It continues to evolve and the last five years have witnessed a succession of acquisitions, closures and re-emergences in response to the changing demands of its global market. The United Kingdom is also strongly influential in vehicle styling, with many British designers and graduates from British institutions directly employed by vehicle manufacturers around the globe. As a direct result of this expertise, Nissan recently located its design studio in London.

The industry faces two key pressures for change. Firstly there is a need to align its technology, product and business performance to deliver customer value in a global industry subject to relentless cost-cutting pressures. Furthermore, environmental protection and safety legislation are set to strongly influence the number and type of vehicles that will be manufactured, marketed and used. The focus within Europe will be on securing these environmental benefits while generating competitive advantage.

Development of smart specialisation policies

Recognising the challenge the industry faced in transitioning to a globally competitive, low carbon future, the Government set out plans to help United Kingdom industry take the lead in the sector. It noted that there is a great deal of investment globally in low carbon technologies yet the market for the next generation of low-carbon vehicles remains wide open. If United Kingdom firms and workers can adapt to the shift in production to ultra-low carbon vehicles, the potential market in the United Kingdom and abroad is huge. The UK automotive industry has reached a consensus as to how this opportunity can be seized and the challenges answered. This cooperation has been fostered through the New Automotive Innovation and Growth Team (NAIGT), which compiled a report planning for a low carbon future and agreeing a technological roadmap leading up to 2050. The NAIGT recommended that government took ownership and worked with the industry to provide strategic direction for the development, production and use of vehicles in the United Kingdom.

The Government accepted they had a role to play and made this a core priority, committing hundreds of millions of support to encourage development and uptake of ultra-low carbon vehicles as well as a GBP 2.3bn package of support to help the automotive sector through the downturn. The Government set out a strategy (*Ultra-low carbon vehicles in the United Kingdom*) to coordinate public sector activity and work with industry and academia to build on the R&D activities of the automotive industry to make the United Kingdom a leading place in the world to develop, demonstrate and manufacture ultra-low carbon vehicles. Alongside this they would accelerate market penetration of LCVs and maximise the benefit to United Kingdom operating firms and supply chains of this accelerated penetration and continue to attract inward investment for the development and production of LCVs.

The NAIGT initiated three phases of work to achieve this.

<u>*Phase 1*</u> *- the NAIGT developed a mutually agreed Original Equipment Manufacturer (OEM) Product Roadmap aimed at the reduction of passenger car CO_2 emissions in line with government targets, and compile a high level Common Research Agenda to deliver the product roadmap*

NAIGT was launched in April 2008 to facilitate the development of a collective strategic view from the automotive industry on the innovation and growth challenges that it faced in the period up to 2025. It was industry-led, facilitated by the Automotive Unit within the Department for Business, Innovation and Skills (BIS)[33] who provided the remit for the Group. Its work was delivered through an industry led steering group of senior industrialists, academics and financial analysts experienced in the sector. The remit provided for them included supply chain development, technology and low carbon product development, technology and low carbon infrastructure and key performance indicators.

Their report set out a 20 year vision for the industry and its recommendations to Government and industry to achieve this. It was accompanied by a study of the competitive status of the United Kingdom automotive industry. Key recommendations were to establish a joint industry-government Automotive Council to develop, guide and implement a long term strategic framework for the industry and to focus the United Kingdom R&D agenda around a new industry-consensus technology roadmap. The report looked at previous failings in government support, namely through a lack of coordination and the absence of a long term strategic policy framework. It noted that the industry was able to survive the recession only through financial and market stresses being addressed by individual companies, industry bodies and government bodies working together, with the NAIGT closely involved.

The report noted that “the creation of a growing low-carbon vehicle market in the United Kingdom by intelligent fiscal incentives, provided it has broad support across the political spectrum, can provide manufacturers with a sufficient incentive to invest in the technology locally, as it goes some way towards removing uncertainty about demand, and provides ‘early adopter’ market insights to those who participate. It is critical that these incentives are technology-neutral – in other words, they must be based on desired outcomes, such as CO2 emissions, not on prematurely chosen technologies such as electric cars.”

A technology roadmap was created by consensus, with an understanding that the individual manufacturers would prioritise certain technologies to fit with their brand values, but Original Equipment Manufacturers (OEMs) share a common view of a high level Technology Roadmap. It was recognised that in the short to medium term, improvements to existing technology could play a big part in emissions reductions whilst in the medium to long term a technology shift to alternative powertrains was required. This needed to be supported by alternative fuel delivery including grid electricity and hydrogen – so it considered not just what could be done in the industry now but also the longer term challenges and the infrastructure and environment in which the industry sat. After the Roadmap, a Common Research Agenda (CRA) was developed with input and agreement from the organisations which developed the Product Roadmap. The aim of the CRA was to map product technology demands to R&D needs. Research was categorised according to six technical areas and across three timeframes which, at this stage, were not connected to current UK capability.

<u>*Phase 2*</u> *- The TSB identified technical areas of existing UK strength, weakness and potential for future development and identified the activities that should be a focus for R&D investment and made strategic recommendations to United Kingdom funding bodies, to maximise the benefit to United Kingdom plc.*

With the Roadmap and CRA developed, it was necessary to assess the United Kingdom’s wider R&D capability in the UK. This was done using a survey and workshops of key industry players to assess: *1)* the current levels of UK activity in research, development and the supply chain; *2)* map the current technology maturity levels of R&D activities underway across CO2 relevant technology areas; and *3)* note United Kingdom strengths and opportunities. 110 companies participated through a survey and workshops. United Kingdom’s main public R&D funding bodies were also approached for information on currently running and recently completed projects within industry and academia. Evidence collected was then assessed against the requirements of the Roadmap for each of a range of 8 technology areas. A simple analysis was then carried out to give an initial indication of likely Return on Investment (RoI) levels across different technology areas. This led to a “scorecard” of 30 technologies across the 8 areas, setting out the United Kingdom’s capability, and research area focus over different time periods and the indicative RoI based on ease of delivery and benefits to the United Kingdom. The scorecard was the culmination of the first two phases of the process. It quickly showed the cumulative, consensus opinion of industry and R&D professionals as to which technologies the United Kingdom was well placed to specialise in and gain the highest returns from.

<u>*Phase 3*</u> *- The Automotive Council established a Technology Group to identify strategic technology direction for “Automotive United Kingdom plc”, setting short-term objectives to drive technology development towards the Product Road Map*

The United Kingdom Automotive Council was established in 2009, chaired jointly by the Secretary of State for Business, Innovation and Skills and an Industry Chair. Its members include a number of industry players and associated bodies. Its partners are BIS, OLEV, TSB and UKTI and, on the industry side, the Society of Motor Manufacturers and Trades. To help take forward the Council’s work, two subgroups were created. The Supply Chain Group aims to build consensus on the challenges in the UK supply chain, enhance dialogue between manufacturers, Tier 1 suppliers and the supply chain on present and future business priorities, review the technology roadmap and develop a high level UK supply chain technology vision.

The technology group seeks to facilitate the roadmap to ultra-low carbon transportation. Its report – the Technology Roadmap - used the scorecard from phase 2 to identify 5 priority areas which could be considered strategic technologies from the UK auto industry. The report's conclusions set out that "An evidence base has been developed for the current capability of the United Kingdom automotive industry. It has revealed an industry which under the correct conditions can compete effectively in the future global marketplace for LCV technologies." This study was then used by the AC to inform their strategic decision-making around prioritisation of United Kingdom automotive technology investment.

Conclusions

The lessons learned can be grouped as follows:

- *The government as a facilitator:* this case study demonstrates government's role in facilitating was is necessarily an industry-led process.

- *Broad stakeholder consultation:* Through wide consultation it was possible for all relevant stakeholders to contribute and commit to a consensus view around future innovation needs within the industry and the research needed to get there. This consensus allowed government to direct public funds for R&D to areas where it would have the most beneficial impact on industry and the economy.

Notes

33 At the time, the department was known as the Department for Business, Enterprise and Regulatory Reform (BERR). BERR was created in 2007 on the disbanding of the Department for Trade and Industry (DTI) and was itself disbanded on June 6th 2009, when BIS was created. The Automotive Unit existed throughout these three departmental changes. For simplicity, this case study will refer to any unit which was a part of DTI, BERR, BIS or DIUS (the Department for Innovation, University and Skills – whose responsibilities now fall under BIS's remit) will be referred to as being part of BIS.

MELBOURNE, AUSTRALIA: THE SOUTH EAST MELBOURNE INNOVATION PRECINCT (SEMIP)

Dan Quinn and Hugh Bampton, Department of Industry, Innovation, Science, Research and Tertiary Education

Regional, national and international policies that have been decisive for prioritisation of domains

The wider Melbourne South East (MSE) region constitutes the Southern and Eastern suburbs of Melbourne, the state capital of Victoria and Australia's second largest city. The MSE region contains 1.4 million people representing approximately 29%t of Victoria's population and 6 percent of the Australian population. The region's innovation system is heavily focused around the suburb of Clayton which contains Monash University, a Commonwealth Science and Industrial Research Organisation (CSIRO) laboratory complex and a strong private sector presence specialising in advanced manufacturing.

Priority setting

The priority setting for the region is divided into plans that are complementary and mutually supportive.

- The wider MSE region, is defined by ten local government areas. In 2009 the region released its renewed Regional Economic Strategy for Economic Development which identified the direction and associated regional initiatives to influence business and employment growth in the region. This strategy is influential at the local and state government level for planning, priority setting and infrastructure investment. The strategy is implemented through three 'Horizon Strategies' aimed at encouraging manufacturing to modernise and adopt new capabilities, increasing the value of the local supply chain and attracting leading management and research staff workers to the region through lifestyle benefits such as quality education, healthcare and recreational facilities.

- The South East Melbourne Innovation Precinct (SEMIP) region has a strong focus on innovation capacity development in the Clayton locality and contributes to achievement of the broader region's priorities. The formation of the SEMIP in 2008 was in response to an identified need of partners to better connect industry with the regions research institutions. SEMIP works in consultation with industry and the organisation is currently chaired by an industry representative. Through its industry, research and government networks SEMIP aims to improve advanced manufacturing specialisation in the region, establishing a dynamic hub of manufacturing in advanced materials.

- The CSIRO is Australia's national science agency. CSIRO has identified five regions within Australia as Global Innovation Hubs to be competitive in applied science at a global level. One of these regions is the Clayton region in MSE that will specialise in advanced manufacturing and materials. The CSIRO Clayton laboratories have a focus on materials science and engineering and will work in collaboration with industry and other research institutions on developing cutting edge technology and techniques. CSIRO is currently working with stakeholders around the design of this precinct.

- Monash University has also initiated a cluster type initiative on its Clayton campus, the Monash Science Technology Research and Innovation Precinct (STRIP). Monash STRIP houses a number of major scientific research centres and companies. Monash University has also launched the John Monash Institute which aims to assist industry in the MSE region by connecting businesses to relevant researchers and assisting in commercialisation by providing business mentoring and facilitating open innovation activities.

Measuring the effects and impacts

Metrics identified by SEMIP to measure success of regional networks and specialisation include: *i)* more business to business, business to research, research to research, research to community and business to community interactions*; ii)* increased investment and new ‘leading businesses’ attracted to the region; and *iii)* high level support professionals moving into designated innovation hubs. Metrics are currently evaluated against qualitative data gathered from interactions with industry and by gauging community and industry support for the organisation through event attendance and brand recognition. Qualitative data, in the form of “real life” success stories help demonstrate to SMEs, the value of networks, like SEMIP in supporting regional specialisation.

Future development for smart specialisation

Current status of the specialisation and prioritisation in the region

The MSE region is a manufacturing intensive region. Its manufacturing sector is characterised by small firms (e.g. less than 200 employees) in comparison to other industrial areas. Data from the Australian Bureau of Statistics demonstrates the concentration of advanced manufacturing and high tech firms in the region: *i)* The region accounts for 9.5% of all manufacturing nationally. The region accounts for 10.5% of Australia’s businesses operating in advanced and materials manufacturing industry subclasses; *ii)* 50% of all manufacturing in the region is related to advanced and materials manufacturing activity and the region is home to 45% of all Australia businesses in industry sub sectors related to advanced manufacturing with turnover more than AUD 2 million; *iii)* Manufacturing employment in the region represents approximately 18.9%, compared to the national average of 8.4% and the Victorian state average of 10.6%; and *iv)* The manufacturing sector also generates the regions highest value products and constitutes most of the region’s exports. Manufacturing activities are highly diverse and are increasingly focused on advanced manufacturing and development.

The increasing strength of advanced manufacturing has, in part, been encouraged by the presence of higher education and research institutions in the region. These include the CSIRO Clayton laboratories, Monash University, the Co-operative Research Centre for Polymers, the Melbourne Centre for Nanofabrication, the Australian Synchrotron and the Small Technologies Cluster. Swinburne University of Technology is also located on the regions periphery.

Ambitions, strategic plans and tools and catalysts in the innovation eco-system

Strategic priorities identified by the SEMIP to support the specialisation and innovation in the region are focused on: *i)* Connecting and interacting - fostering knowledge sharing, problem solving and open innovation environment that encourage businesses and researchers to explore new frontiers in science, technology, and business operations and processes; *ii)* Accelerating business innovation - strengthening the innovation capabilities of individual businesses and researchers by providing businesses with services directly related to securing a competitive edge; and *iii)* Establishing world class regional facilities and environments that attract and retain businesses and create attractive and exciting places for people to learn, live, invest and work.

Stakeholder dialogue is the primary tool used by SEMIP to build specialisation in the region. Events such as business breakfasts, innovation showcases and other ‘meet and greets’ allow the network to identify emerging innovative activities and collect case study examples of regional specialisation. This reflects the bottom up approach of the SEMIP organisation, which is driven by the pre identified needs of it’s constitute partners, rather than a top down approach driven by remote analysis of a region. SEMIP’s strategic plan is also used to align goals and assist collaborative efforts. Formalising the regions goals makes all partners aware of where they should be directing their efforts and for what purpose. The broader MSE regional economic plan has also feed into this process by aligning economic priorities among local government bodies in the region.

Bottlenecks and threats

Regional innovation and specialisation strategies need to be regularly reviewed to ensure they promote a clear vision across the region responding to changes in regional developments. A lack of agreed goals and desired outcomes for the region represents a serious threat. One of the key strengths of organisations such as SEMIP is its ability to act independently of government and be driven by local specialisation and identified growth opportunities.

Identified influencing factors across the innovation system that can impact on specialisation priorities include: *i) Education:* It is important to maintain and improve the quality of education within the region, from early childhood, to ensure that the region can sustain its skilled workforce; *ii) Migration Policy:* The MSE is a destination for many recent arrivals to Australia. Migrants contribute to regional growth and businesses development, particularly through the matching of skilled migrants with skills shortages or realising potential for international engagement and access to networks; *iii) Business aversion to R&D expenditure and open collaboration:* Encouraging a cultural change in the private sector, particularly among SMEs, in attitudes towards R&D. This includes easing existing aversion to an open innovation process involving multiple partners, especially among companies in advanced fields. This requires a new and more open approach to addressing intellectual property concerns in collaborative engagements between multiple partners; *iv) Lack of knowledge about research capabilities and government grants in industry:* Organisations like SEMIP are effective in disseminating information about the possibilities for businesses engagement with government and the research community. However, the private sector was still generally under informed about the possibilities within SEMIP. This was put down to a number of reasons; the lack of a one stop shop for information; the diverse range of grants and agencies; the time involved required to understand and apply for grants; and the lack of clear information about what researchers can offer SMEs; and *v) High Exchange Rate:* The Australia dollar has reached record heights in recent years and has maintained or exceeded parity with the US dollar since late 2010. This has made it more difficult for Australian companies to compete internationally and re-enforced the need for advanced manufacturing prowess and increased regional collaboration.

Lessons learned and conclusions for policy

Policy mechanisms supporting the development of advanced manufacturing specialisation and networks in the region include:

- *Networking:* The establishment of networks (both informal and formal) are essential in driving stakeholder participation in the development and sustainability of a region. Individual contacts and relationships form an important part of a regions economic fabric. Networking is also essential to build and develop international relationships.

- *Capturing success stories:* Accurately capturing and recording success stories are a key part of demonstrating value and alleviating concerns about the risk of interaction.

- *Buy in from industry:* Research organisations and government bodies can struggle to connect and establish working long term sustainable relationships with industry. Achieving long term buy in from industry is fundamental to the success of regional initiatives that seek to grow or direct industry development.

- *Leadership:* The importance of individuals who are willing to drive an organisation forward. While the concept of champions is not new, the shared characteristic of those important within SEMIP and its partner organisations was there long history of involvement in the region and its institutions.

- *Formalising and Branding*: Efforts to builds it's "brand" recognition strengthened the capacity of the regions innovation system by allowing more networks to form. As an identifiable body representing innovation developments in the region, SEMIP has helped industry increase confidence in approaching research organisations for collaboration

- *Promotion of liveability:* A skilled workforce is a fundamental aspect of driving economic growth, especially in high tech manufacturing or research. "Soft" factors, like the liveability and access to social and recreation infrastructure influence decisions in the location of business operations.

- *Concentration of infrastructure:* Research infrastructure helps draw a highly skilled workforce to an area. The research infrastructure provides a further economic safety net to the region by providing on-going employment and creating an environment that allows workplace mobility, and hence the possibility of open innovation and idea "cross fertilisation".

LOWER AUSTRIA: REGIONAL POLICY MIXES FOR SMART SPECIALISATION – HOW TO DEVELOP SUSTAINABLE INDUSTRY SCIENCE INTERACTIONS IN A REGION WITHOUT EXPLICIT LEAD SECTORS

Marija Breitfuss and Christian Hartmann, Joanneum Research, Graz with the support of: Irma Priedl, Department of Economics, Tourism & Technology of the Regional Government of Lower Austria and Simone Hagenauer, Eco plus, the Business Agency of Lower Austria

Regional, national and international policies that have been decisive for prioritisation of domains

Priority setting in the governance system

Innovation strategy in Lower Austria has been developed since 1997. The first multi-annual strategy was RIS, which covered the period from 1999 until 2008; the second one (currently in place) is the Economic Strategy Lower Austria 2015, which includes the updated innovation strategy and defines a policy mix and budgetary focusing on a limited number of priorities targeted: *i*) Innovation and Technology; *ii)* Qualification; *iii)* Cooperation; *iv)* Internationalisation; *v)* Start-ups; and *vi)* Sustainability.

Key policy instruments and investments

The main key policy instruments in the Lower Austrian policy mix can be divided into three groups:

- *Infrastructure:* In whole Lower Austria a technology network was built up to strengthen lead sites and to help peripheral and structural weak areas. Following infrastructure measures can be mentioned: 4 Technology Centres in Tulln, Krems, Wiener Neustadt and Wieselburg (is still being discussed); 7 Start-up centres in Amstetten, Berndorf, Hollabrunn, Krems, Ternitz, Waidhofen/Ybbs and Wiener Neustadt and 17 business parks with about 776 companies and 18 300 employees.

- *Advices and services:* Lower Austria implemented programmes ("soft measures") providing services to support R&D&I activities of SMEs. Its innovation strategy focuses on the establishment and expansion of targeted industrial competencies. At the fore, there is the on-going development of existing and formation of new value creation chains, especially in technological/market niches, as well as the horizontal linkage to value creation networks, following already established programmes (e.g. Technopole programme supporting technology oriented location development; Clusters and network programme supporting innovation in businesses through collaborative projects and the TIP – Technology and Innovation Partners supporting single firm R&D&I projects). Additionally Lower Austria piloted a landmark scheme to encourage SMEs to employ recent university graduates in order to strengthen their technological and innovation capacities. This innovative action – part-funded by the ERDF – targeted small SMEs in rural areas to provide them with support from the "Innovation Assistant". These are 'intrapreneurs' with a university background managing innovation projects tailored to the specific needs of the SME (Priedl 2011c).

- *Finance:* Funding schemes for companies are not stand-alone financing instruments but combined with soft measures described above, e.g. a funding scheme for cooperation projects and services of the Cluster managements, a funding scheme for technology projects and services of the Technopol managements, or a funding scheme for R&D projects and services of the Technology and Innovation Partners.

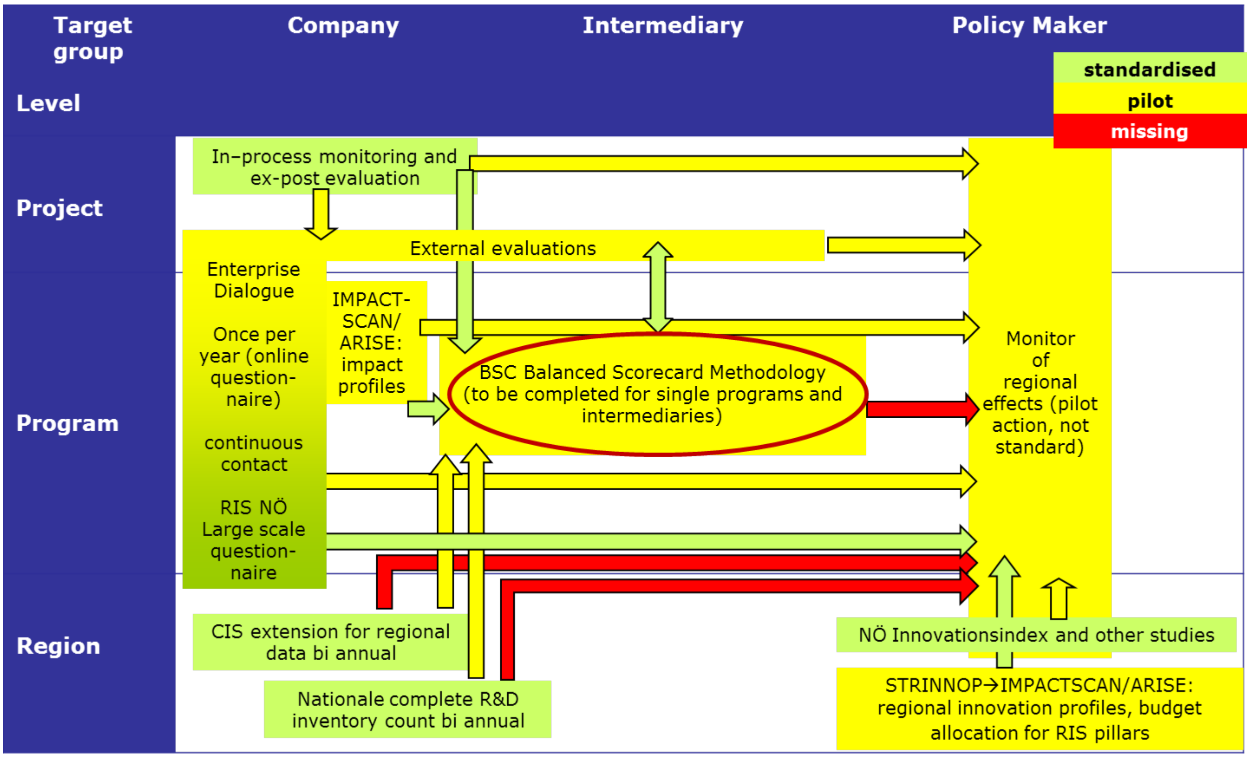
Coordination activities to support S3

Lower Austria is characterized by the distribution of economic and research capacity to several small to medium sized locations, by its geographical proximity to Vienna with its extensive research infrastructure and by its integration into the "Vienna Region" and Centrope. The Lower Austrian innovation system has improved significantly in the last years, this is not least due to the fact that it started already in 1997 to implement the (in this time in Austria a unique process) Regional Innovation Strategy of Lower Austria (RIS NÖ). This development of the innovation system included on the one hand the strengthening of capacities in Lower Austria, which were in their early 90s significantly below average; and on the other hand a specific linkage to available competences in the Vienna and Centrope region. The efforts of the Lower Austrian RTDI policy in the past decade are clearly visible in the dynamic and positive development of RTDI actors and R&D expenditures, partly due to the communication and consensus via RIS NÖ (Steering Committee RIS NÖ)

Measuring the effects and impacts

Until now, effects in Lower Austria are being monitored and evaluated at three level approaches and at three target groups: *i) Project level:* Input, output and direct effects on the regional companies of individual public intervention&/project (support service and/or financial funding); *ii) Programme level:* Agreement on objectives; Total input, output and impact of a public support programme at intermediaries (Balanced Scorecard) and companies (company survey, carried out every 5 years); Management by objectives; Evaluation of fulfilment of objectives; and *iii) Regional level:* Agreement on economic objectives; Effects of regional (innovation) policy and its interventions on the region of Lower Austria; Statistical analyses and comparison (R&D survey, Community Innovation Survey, company specific monitoring).

Figure 2.5. Impacts of Regional Innovation Policy



Source: (Priedl 2011b)

Future development grasping the opportunities for smart specialisation

Current status of the specialisation and prioritisation in the region

The Lower Austrian research landscape is significantly dominated by the business sector. Within the business sector there are – compared to other Austrian regions as Carinthia and Vienna – no significant concentrations of activities to a small number of sectors. Instead, R&D activities are spread over a large number of different sectors. R&D expenditures in the Lower Austrian business sector approximately doubled in the period approx. from 2002 to 2009. Contrary to the Austrian trend, Lower Austria could slightly shift R&D expenditures from the service sector to the manufacturing sector. The financing of R&D expenditures in the business sector in Lower Austria in 2009 accounted for 80.6 % of the (domestic) business sector. In terms of innovation behaviour in Lower Austria, the Community Innovation Survey tells us that almost every second company (49.4 %) in Lower Austria was innovating (was introducing or implementing product and/or process innovations) from 2004 to 2009. Including organisational and market innovation, two of three Lower Austrian companies carried out innovation (65.5 %).

In Lower Austria especially small companies (> 9 employees) were largely engaged in innovation activities. Still below average are innovation activities in the service sector. Lower Austria is characterized by innovation activities above average in the manufacturing sector and a need to catch up of the service sector, compared to Austria in the period from 2002 to 2004 as well as from 2004 to 2006 (Ploder et al. 2010). As Lower Austria does not significantly concentrate its activities to a small number of sectors, it has been decided to focus on functional priorities, such as the establishment of Technopols and Clusters to identify and develop relative specialisations in niche technologies or markets. Since experiences were very positive with these instruments, they will be continued in the future. Currently, there are discussions to establish a fourth Technopol in Wieselburg, however, it remains to be seen if the location would be able to fulfil all the conditions necessary for the establishment of a Technopol. Currently there are still debates whether there is enough tertiary education in Wieselburg.

Ambitions, strategic plans and catalysts in the innovation eco-system

As mentioned in the chapters above, Lower Austria follows the Continuous Improvement Process of the Regional Innovation System Lower Austria NÖ, which was initiated by the Regional Government of Lower Austria in 1997 with the development of the Regional Innovation Strategy. The Basis for the CIP RIS NÖ is a need and action oriented approach following the PDCA cycle. Participants of this process are customers, intermediaries and the Steering Committee RIS NÖ, which supports the process.

Opportunities for cross-border and international eco-system development

Lower Austria is in the lucky position to surround Vienna and has the possibility to take advantage of Vienna´s research infrastructure. No other region of Austria can profit of this advantage. One can therefore speak of spill-over effects, as the Viennese research and innovation infrastructure has positive effects on the structure of Lower Austria. Cross-border activities do exist, but as Lower Austria is very close to Czech, Slovakian and Hungarian regions, more measures with this regard could be carried out. Currently Lower Austria is participating in: *i) International co-operation in projects*: CORNET, INTERREG 4C, CIP; and *ii*) *Strategic networks*: EURADA (The European Association of Development Agencies), ERRIN, European Cluster Alliance, CENTROPE, ERIK-ACTION (Upgrading the Innovation Capacity of Existing Firms), TCI, S3 Platform.

Stakeholder and policy dialogues to achieve the ambitions

In Lower Austria already in 1997, at the beginning of the Regional Innovation Strategy Lower Austria, the steering committee RIS NÖ was established. The committee comprises all relevant technology and innovation service providers and is responsible among other things for the consensus building of required measures to improve the regional innovation system of Lower Austria. In addition to the steering committee RIS NÖ, each cluster initiative is accompanied by cluster advisory board made up of companies, R&D institutions and intermediary organisations. Companies are directly involved through large scale questionnaires and strategy meetings ("Enterprise Dialogue"). In Lower Austria knowledge creation achieved by stakeholder and policy dialogues is implemented bottom up as well as top down. Good examples for a top down process are meetings of the cluster advisory board, where topics e.g. achieving of efficient and sustainable systems, are being discussed. The feedback and opinion of cluster partners is gathered in a next step.

Bottlenecks and threats for the innovation eco-system that hamper entrepreneurial discovery

The advantage of Lower Austria in terms of RTDI is definitely the fact that it does not have to offer basic research and tertiary education only by itself, but is of use and benefits from the surrounding. Therefore Lower Austria tries to be careful and to create its unique selling proposition and not to duplicate specialisations of surrounding regions. Lower Austria of course still tries to adapt its priorities and strategies to make use of the available infrastructure outside the region, but nevertheless to find niches in this process. The big challenge in Lower Austria is that the business sector is characterized by a number of small companies lacking the innovation capacities. In future it will be necessary to address also this group of companies to integrate them into the innovation process and landscape.

Lessons learned and conclusions for policy

The lessons learned can be grouped as follows:

- *Intra- and inter-regional collaboration*: Lower Austria's proximity to the knowledge-intensive Vienna region and the neighbouring Czech and Slovak Republics and Hungary in close vicinity present a specific set of challenges and opportunities. The region tried to make the best of this position by focusing on cooperation both with Vienna, and within the cross-border CENTROPE region, but also with other neighbouring regions, such as Upper Austria, to allow the development of synergies, the opening of new markets for local companies and complementarity between value chains.

- *Use of data and diagnostic tools*: The region's innovation strategy is based on both qualitative and quantitative data and takes into account local and external conditions. Lower Austria has gone through extensive prioritisation processes thanks to several strategic exercises since the mid-1990s. In 1998, a project for the continuous improvement of its regional innovation system was started. The regional government carried out a SWOT analysis, sent questionnaires to its companies, organised workshops and carried out interviews with stakeholders. It also completed a survey of the activities of other similar regions. Based on analysis of the region, several actions aimed at addressing the innovation needs of companies were undertaken, among them the creation of three 'Technopoles' and Clusters. In this way, Lower Austria invested in improving those specialisations with a potential for excellence and in creating complementarities in those areas where knowledge and resources have to be shared with other regions, therefore steering clear of excessive specialisation and any risk of trying to excel at everything.

- *Impact of data and diagnostic tools:* Lower Austria made positive learning experiences with the establishment of these tools among others, and will in the future continue to support them, in the case of Technopols, the expansion and establishment of another Technopol in Wieselburg is being considered. A recent independent study on the economic contribution of these specialisations and the related support measures (Technopoles) confirmed their direct and multiplier (indirect and induced) effects on value added, employment, tax revenues and social security contributions as well as on beneficial impact on structural change and value creation in the region. Further they support the structural transformation of the Lower Austrian economy and promote the creation of a knowledge-intensive economy (European Commission 2011). Lower Austria is one of the regions not specializing on explicit lead sectors, but on functional priorities (mainly Technopols and Clusters). In this respect Lower Austria learned, that it was able to overcome the effects of the crisis more effectively than other regions, which specialized on specific sectors. Therefore Lower Austria will also in the future pursue the target to position itself more broadly and to focus on innovation.

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UPPER AUSTRIA: SMART GOVERNANCE FOR SMART SPECIALISATION OR MAKING USE OF MIXED TOP-DOWN, BOTTOM UP PLANNING FOR REGIONAL COMPETENCE DEVELOPMENT

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Regional, national and international policies that have been decisive for prioritisation of domains

Priority setting in the governance system

The Upper Austria regional economic and research strategy can be considered as a comprehensive strategy with several aspects resembling the rationale of smart specialisation. Technology clusters, relevant higher education and technology networks exist in strategic sectors. The current strategic framework comprises the "Regional Competitiveness Upper Austria 2007-2013 Program" and the "Innovative Upper Austria 2010plus" which has been approved in 2010 and will run until 2013. Both will be updated thereafter in order to include relevant smart specialisation features.

Areas of thematic specialisation are identified within two categories: First, the existing strengths of the regional economic- as well as research sectors (the so called double strength) like mechatronics and process automation, innovative materials (especially plastics, materials steel, light metals) and information and communications technology; second the target economic sectors for the future (life science, logistics, renewable energies and the service industries). Governance structures were defined as bottom up, with constant interactions between regional policy makers and actors in the innovation field.

Key policy instruments and investments

Several features of Upper Austria's innovation system and policy are of key importance from the perspective of smart specialisation analysis. Firstly, with the cluster and networking policy the regional government set a focus on key fields of specialisation for which a regional potential was already present. Thus, since 1998 the development of economic and technological strengths through the interlinking of companies and R&D institutions in clusters, competence centres and networks is an important pillar of the regional innovation policy portfolio. Policies which aim at the development of regional connections are carried out in eight cluster-initiatives: automotive, plastics, furniture and timer construction, food, eco-energy, health technologies, mechatronics and environmental technologies. Furthermore, four inter-branch thematic networks in the fields of human resources, logistics, design and media and energy-efficiency are supported. Complementary policy measures to the shaping of optimal cluster framework conditions in the narrow sense (i.e. networking and cluster promotion activities, consultancy, qualification) are measures related to R&D co-operation and technology transfer. Within this context, the cluster-oriented fund for innovative co-operating projects is clearly part of the smart specialisation strategy.

Secondly, Upper Austria can be considered as a "networked regional innovation system", because it not only has a set of well-developed clusters, but has also implemented formal procedures to connect all relevant actors and committed them to formulate a coherent strategic program with a set of corresponding measures. Above that, all important actors from government, academia and business seem to be in frequent informal contact showing features of a regional "triple helix" (Etzkowitz and Leydesdorf 2000) structure.

Participative policy making in Upper Austria means continuous reflection and learning at various levels and in intercommunion with different actors. In order to take advantage of the exchanges, new learning culture needs to be established, in particular inter-organizational one, comprising representatives from industry, politics and society involved in the strategy setting process, in respect of the overall system by means of communication with experts and STI implementers and via ex-post evaluations.

Coordination activities to support S3

Another responsibility for Technology and Innovation Policy in Upper Austria is linked with the Ministries of the Upper Austrian Government as well as with the responsible regional government's departments and directorates for "regional planning, the economy and rural development" (department economic affairs) and "education and society" (department Research and Development and Education). The TMG acts as the project manager of the strategic program Upper Austria 2010plus. In conceptualizing a regional technology policy, the management board of TMG tries to follow a "technical" approach as independent from politics and lobbies as possible.

In 2011 all tertiary education and research institutes owned by Upper Austria as well as all R&D, and innovation and economy "promotion agencies", owned by majority by Upper Austria, have been organized under the common roof of the newly founded Upper Austrian Innovation Holding GmbH. The major goals are to further improve the competitiveness of Upper Austria through an intimate linkage of three elements - education, science and business; to avoid duplicate work within the companies of the Upper Austrian Innovation Holding and to identify and implement (roll out) best practices with all companies of the Upper Austrian Innovation Holding.

Measuring the effects and impacts

Until now, effects in Upper Austria are being evaluated at three level approaches and at three target groups. Three level approach:

- I) Project level (Input, output and direct effects on the regional companies of individual public intervention&/project (support service and/or financial funding). A typical example is the evaluation on Upper Austria plastic location of 2011.

- II) Program level (Agreement on objectives; Total input, output and impact of a public support program at intermediaries and companies (company survey); Management by objectives; Evaluation of fulfilment of objectives. A typical example is the evaluation of Cluster initiative by Technopolis 2001.

- III) Institutional level (Agreement on economic objectives; Effects of regional (innovation) policy on the performance and competitiveness of Upper Austria; Statistical analyses and comparison (R&D survey, Company specific Survey). A typical example is the evaluation of TMG with focal points on the Strategic Program "Upper Austria 2000+" by Technopolis 2004.

Future development grasping the opportunities for smart specialisation

Current status of the specialisation and prioritisation in the region

The regional economy of Upper Austria is characterized by its very strong industrial core. The strong industrial sector is also reflected in the landscape of R&D topics of Upper Austria´s research system. The Upper Austrian research landscape is significantly dominated by the business sector, however, with the JK

University a publicly funded academic university is located in the region of Upper Austria. In Upper Austria approx. 80 % of all R&D is done by industry. The share of the (JKU) university is relatively small, since the JKU does only get 5 % from the total Austrian university budget, whereas Upper Austria produces more than 25 % of Austria´s technology exports.

Regional Upper Austrian R&D intensive important industry sectors are “automotive” (with leading companies BMW Motoren, MIBA, MAN, KTM), “machinery & engineering” (SIEMENS VAI, Engel Austria, SKF, Ebner, etc.), “electrics and automation ” (Fronius International, KEBA) and the materials sector “metals” (steel (voestalpine), aluminium (AMAG), “plastics” (Borealis) and “wood/paper” (LENZING etc.)

Ambitions, strategic plans and catalysts in the innovation eco-system

Upper Austria uses a continuous process to identify new potential growth areas to be supported. The main focus areas in the strategic economic and research programs are determined via stakeholder consultations, studies and analysis of regional requirements. It requires a collaborative approach of decision-making. The identification of prioritized sectors and domains in the regional innovation framework of Upper Austria has been based, at least partially and in some cases essentially, on regional assets and existing capacities, as well as on the analysis of megatrends. Regarding the megatrends and the “big global R&D topics” (e.g. nanotechnology, biotechnology, genetic engineering etc.) Upper Austria decided to not blindly “copy” the themes, but to focus specifically on “Upper Austria´s Double-Strongpoint-Fields”, regardless if they were niche-technologies or not.

Opportunities for cross-border and international eco-system development

Upper Austria is a province in the heart of Europe with open-minded inhabitants and a very export oriented economy. The active participation within the European Union, the close cooperation with neighbouring and partner regions, and the collaboration in interregional networks and working communities constitute focal points of the region´s relations. Upper Austria contributes to the European Territorial Co-operation Programs (INTERREG) Austria – Czech Republic and Austria – Germany/Bavaria (cross-border co-operation), Alpine Space, Central Europe and South East Europe (transnational) and the interregional co-operation Program.

Bilateral cooperation is maintained and enhanced with the neighbours Bavaria and South Bohemia, and as well as with regions such as Baden-Württemberg, South Tyrol, Alsace, Hamburg, North Rhine-Westphalia, Saxony, and Heves, and with countries such as Croatia and Israel/Palestine. Within the framework of the European Union, Upper Austria also focuses on an intensive economic cooperation with the member states and candidates from the East and Southeast of Europe.

In order to deepen economic cooperation with its neighbouring regions Upper Austria founded the European Region Danube-Vltava on June 30th 2012. The preparation process started in 2009 with a network analysis and continued with a study on the economic potentials of the European Region.

Stakeholder and policy dialogues to achieve the ambitions

In Upper Austria knowledge creation achieved by stakeholder and policy dialogs is implemented bottom up as well as top down. The strategic program “Innovative Upper Austria 2010plus” is a nationally and internationally successful example of strategy development and program design that is supported by participative elements. Basic elements of the process design for the strategic program “Innovative Upper Austria 2010plus” were taken from its two predecessors: the strategy program “Innovative Upper Austria 2010” and the “Innovative Upper Austria 2000+”. This is particularly the case for the bottom-up dynamic which was developed in thematically focused working groups in which agents from the business side, special interest groups, and from the social partners (with the involvement of the members of the Upper Austrian Research and Technology Council) in Upper Austrian participated.

The co-ordination, priority setting and aggregation of the programme can be in conflict with the dynamic of a broad and participative bottom up process. This is due to the fact that it is often hard to find a unanimous definition framework when a large number of agents are involved – even when a uniform process framework is in place. A further challenge is the setting of priorities amongst goals and approaches – especially when these are set within the process and without outside reference. Another major challenge concerns the division of competences as well as the final control of implementation and final success of the project. A large number of the agents participating in the program development (e.g. as promoters of power, experts, agents responsible for the process, etc.) are not suitable to take on these roles.

Bottlenecks and threats for the innovation eco-system that hamper entrepreneurial discovery

Future threats for the innovation eco-system in Upper Austria that may hamper entrepreneurial discovery are the lack of on-going and systematic evaluations and assessing the effectiveness of strategy. Further evaluation of the strategy Program should also focus on ensuring that support is directed towards economic sectors with significant weight or opportunities for improvement could be taken sufficiently early.

Lessons learned and conclusions for policy

The lessons learned can be grouped as follows:

- *Functional priorities*: Upper Austria is a region not specializing on explicit lead sectors, but on functional priorities and technologies. In this respect Upper Austria learned, that it was able to overcome the effects of the crisis in 2008 more effectively than other regions, which specialized on specific sectors. Therefore Upper Austria will also in the future pursue the target to position itself more broadly and to focus on innovation.

- *Weak points*: Even if Upper Austria made good experiences with its priority setting, there are still some weak points in Upper Austria´s innovation system, including: *i)* Underdeveloped und underfunded university sector compared to the economic and industrial strength of Upper Austria;[34] *ii)* underdeveloped (public) research sector, however growing; *iii)* Lacking critical mass on human capital in (public) R&D and; *iv)* Growing gap of R&D HR resources, especially in the engineering sciences (“Brain drain”).

- *Areas for improvements:* Out of these reasons and to reach the aim of improving the competitiveness of Upper Austria´s technological export industry even further and becoming a leading European innovation system, Upper Austria needs to: *i)* Continue its policy of Smart Specialisation in Upper Austria´s Double Strongpoint Fields (strategy of global leadership in technological niches, rather than following a “me too” strategy in the big global mega topics like nanotechnology, biotechnology, genetic engineering etc; *ii)* Create critical mass in R&D and Innovation in selected areas; *iii)* Facilitate innovation also in selected rural areas; *iv)* Create an integrated, consistent and sustainable Innovation Assessment Methodology (Output-Outcome-Impact); and *v)* Encourage a smart mixture of instruments in the policy mix.

NOTES

34 Upper Austria is the Austrian leading region in technology exports in Austria.

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SOUTH MORAVIA, CZECH REPUBLIC: REGIONAL INNOVATION STRATEGY IN SOUTH MORAVIA REGION: SEARCHING FOR A SMART SPECIALISATION, UNDER THE CONDITIONS OF A TRANSITION ECONOMY

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Regional, national and international policies that have been decisive for prioritization of domains

Before focusing on South Moravian regional innovation policy, two fundamental characteristics that distinguish the Czech Republic from the countries which score the highest on various innovation scoreboards (e.g. IUS 2011) should be presented. First, from a macroeconomic point of view, the Czech Republic, as well as other transitional economies in Central Europe, is a FDI branch plant driven economy characterised by a relatively underdeveloped sector of knowledge-intensive business services. Manufacturing thus represents the main driver of competitiveness, but it has a quite different structure compared to the innovation leading economies. Key industries are dominated by multinationals' plants usually without strategic marketing, sales and R&D operations, which has serious impacts on the extent and quality of innovation demand across the business sector. Local enterprises typically compete in market segments of standardized goods and services with high price elasticity and increasing competition from countries with even lower production costs (e.g. Romania, Turkey, or China). Despite this trend, most entrepreneurs do not have the ambition to re-orient towards markets where higher-rank innovations are the key to long-term success.

Second, from the evolutionary perspective, the innovation policy of the Czech Republic, as a whole, and of the various Czech regions is in something of a "catching-up phase". It is based on copying foreign best practices, often without the necessary adaptation of such practices to the specific characteristics of the national and particular regional innovation systems. Since the mid-nineties, national economic development strategy has been strongly focused on supporting FDI inflows into manufacturing, aiming to create large numbers of new jobs in subsidized industrial zones across the country. The focus of the strategy changed slightly when some major investors (e.g. Flextronics in Brno, Philips in Hranice, etc.) closed down their manufacturing facilities and left thousands workers unemployed. The incentive system was subsequently adjusted to target FDI involved in higher value added operations (high-tech manufacturing, R&D, strategic services etc.). Since 2000, central authorities have adopted several strategic documents concerning innovation policy, including two National competitiveness strategies (2005, 2011). However, they are rather formal documents with, in many cases, relatively weak direct implications for the committed institutions' real priorities and budgets.

There are fourteen NUTS III regions with their own governments. Each of them has its own regional innovation strategy. As at the national level, these are mostly formal documents. There are a few exceptions, one of which is presented in this case study – the South Moravia region, which is a leader in innovation support in the Czech Republic (Blažek, 2010). The economy of South Moravia is driven by firms concentrated in the regional capital (the city of Brno), a dynamic and innovative centre and the second largest city in the Czech Republic (500 thousand inhabitants in the city agglomeration), while the surrounding area lags significantly behind the national average in the key socioeconomic indicators (e.g. the level of tertiary education). Origins of the South Moravian innovation policy date back to 2001-2002, when the first generation of Regional innovation strategy (RIS SM) was drafted within the framework of the EU-funded project InterpRISe. The main rationale for starting this process was to change from a non-sustainable exogenous development strategy aimed at creating jobs by attracting foreign direct investments (FDI) to a more endogenous approach. This policy reorientation received strong political support from the newly constituted regional government. The main factors behind this unusually strong political support were: the high unemployment rate; the delocalization of the first large FDI plant leaving more than 2000 unemployed people; and the start of Lisbon Strategy debates, all of which motivated newly appointed politicians "to do something unusual in the Czech Republic but standard in the West".

The main output of the first generation of RIS, the first RIS in the Visegrad region, was the establishment of the South Moravian Innovation Centre (JIC), which became responsible for implementing this strategy. The second generation of RIS was prepared by JIC in 2005 as a response to joining the EU and as a means for utilizing the opportunity to channel EU Structural funds into innovation support measures. Both generations of RIS were focused primarily on supporting start-ups (incubators, financial services, consulting and the establishment of a centre for technology transfer). The crucial essence of regional innovation policy has been the process of building a consensus about the region's future. At the beginning, there was only a very small group of people, not more than five, who were true promoters. Looking back, the main results of innovation policy in the period 2001 – 2007, although not anywhere explicitly expressed beforehand, were: *i)* a significant broadening of a group of people across key stakeholders who trusted each other and both wish and were able to achieve common objectives; and *ii)* a significant improvement in the quality of staff inside the Regional Authority and intermediaries such as JIC or RDA to manage and support the implementation process.

These results represented the key condition for introduction of a truly smart specialisation approach to the third generation of RIS SM which was adopted in 2009. At the beginning of the formulation process for the new RIS SM, representatives of the Regional Government, the city of Brno, universities and intermediaries agreed on the following strategic goals: *i)* to expand overall intervention from start-up support to include cluster development, technology transfer, internationalization etc.; *ii)* to prepare the region for the new 2007-13 EU programming period in order to efficiently stream financial funds into the region; and *iii)* to bolster already existent partnerships by establishing permanent structures, such as the Steering Committee (high-level political group), the Coordinating Committee (expert group) and four thematic working groups comprising 80 people from all three triple helix environments.

Based on an extensive survey results and on an expert assessment by working group leaders, four functional priorities were formulated: *i)* technology transfer; *ii)* services for companies; *iii)* human resources; and *iv)* internationalisation. Strategic goals and activities were proposed for each priority axis. In order to ensure proper implementation of the strategy, an Action Plan for 2009 - 10 with 27 projects was prepared. In 2012, a second Action Plan for 2011 – 2013 is in the process of implementation. In 2012, an interim evaluation was started. This is being performed by RIS secretariat based at JIC and involves open discussions with stakeholders about the results. A comprehensive external ex-post evaluation is planned to be conducted in 2015.

Key policy instruments and investments

The key instruments in the third generation of RIS in South Moravia include:

- *Technology transfer*: *i)* the creation of a joint technology transfer centre for all universities and other research organizations in the region; and *ii)* innovation voucher scheme with the aim of initiating new business – to – science cooperation projects.

- *Services for companies*: *i)* incubation programme - three business incubators with more than 7000 m2 office and laboratory space, micro-loan fund. Each start-up has its own consultant, who can connect the new entrepreneurs with growing network of mentors and coaches either nationally or from abroad; *ii)* pre-incubation program focused on people (not only students or graduates) who have the ambition to start their own business; and *iii)* cluster development services – most important the building up (incl. soft facilitation of cooperation) of the Centre of competence in machine tools.

- *Human resources: i)* SOMOPRO is a program offering 3-year incoming grants for distinguished researchers and grants for re-integration of research expats; *ii)* Brno PhD Talent is a grant scheme for supporting most talented PhD students in science and engineering; and *iii)* several special schemes focused on raising secondary level students' motivations concerning research and technology including Science Learning Centre (Centre for popularisation of science).

- *Internationalization: i)* consultancy focused on drawing FP7 funds; *ii)* Brno Expat Centre*;* and *iii)* International Secondary School.

Future development for smart specialisation

The first two generations of RIS were mainly about the development of incubators and services for innovative start-ups. The third generation is about fundamental progress of regional innovation policy in various ways: *i)* a large survey (much larger than in previous versions of RIS SM) was conducted among businesses and research teams (more than 200 in-depth interviews in 2008) as a source of strategic intelligence for the design and implementation of the strategy; *ii)* an evaluation system is under development; *iii)* a much higher focus in terms of specific industries has been introduced. Based on a combination of desk research and extensive survey, key industrial branches have been identified – mechanical engineering, electronics, ICT, life – sciences; and *iv)* a much broader set of measures facilitates significant synergies across all priority axes.

The third generation of RIS SM is, therefore, the first comprehensive strategy for regional economic development based on the principles of the S3 approach in South Moravia (and likely in the Visegrad region). The methodology for its formulation was based on the results of the Constructing Regional Advantage project (EC 2006). Currently, JIC is preparing the process of formulating the fourth generation of RIS SM (2014 – 2020).

External challenges to the regional innovation system

Several challenges need to be tackled. They can be viewed rather as the framework conditions for the formulation and implementation of RIS South Moravia. However, they are quite different in terms of their nature, as are possible solutions. These are key challenges that can be regarded as external to the regional innovation system:

- *Mismatch of research supply vs. innovation demand hampers the entrepreneurial discovery process:* It can be viewed as a result of the prevailing position of the regional and national economy within intricate global value chains. Research is global. It means that the best research teams in South Moravia are dealing with global research issues. Therefore, they produce knowledge which is potentially usable only by companies dealing with the development of world class technologies, which need to use new knowledge and have the internal capabilities to do so. However, a minimum of local companies are in the position of a "world technology leader" or at least a "smart technology follower". As a result, it is difficult to find common interests (in terms of B2S and B2B R&D collaboration) and transform them into a concrete long-term R&D agenda. Low mutual trust and skewed perspectives about motivations of potential partners (e.g. researchers 'perspective "entrepreneurs' motivation is to socialize their costs", entrepreneurs ‘perspective “these researchers waste public money on something useless” etc.) is reinforced by the above described mismatch.

- *Inadequate national (not only innovation) policy:* The ongoing absence of fundamental national reforms (e.g. reforms of education system) and instability in several key issues (e.g. financing of public research), together with proliferating corruption and very low level of people’s trust in politicians, creates bad atmosphere for implementing any development policy. On the other hand, there is a growing demand among business people as well as economic development professionals for an elaborated national innovation strategy that covers the whole eco-system, incl. the quality and relevance at all level of education, institutional setting etc. If several major changes at national level is adopted RIS SM4 will get significant impetus for delivering value for money that has been invest into it since 2002.

Internal challenges to the regional innovation system

Beside them, following challenges are endogenous to the regional innovation system:

- *Strategy focus*: The four defined key industries are too broad to focus resources on specific knowledge bases (domains). On the basis of 90 interviews with entrepreneurs and CEOs from medical technologies and scientific instruments companies, the new methodology for better delimitation and deep understanding of key knowledge bases is being developed. The aim is to identify as many as possible narrow fields in which regional economy has significant position in the world market (e.g. electron microscopes, cyber security SW). In the second step, the problems within such narrowly defined innovation systems (incl. external linkages) must be taken in to account in order to develop dedicated instruments for the next generations of RIS SM. RIS SM 4 will consists of horizontal instruments with some specifics focused on key narrowly defined industries (e.g. pre-incubation program with common and specific modules), and vertical instruments focused on key knowledge bases that in fact represents individual specifically structured innovation systems with specific problems that can’t be addressed with general horizontal instruments.

- *Business involvement*: Further steps towards more focused policy based on strategic intelligence cannot be achieved without more intensive commitment of local industry leaders. It is necessary to increase their commitment in the process through: *i)* personal engagement during the formulation of the vision, strategic objectives and instruments for their achievement; and also *ii)* in the Steering Committee and in expert groups. On the basis of broadened business commitment, the strategic (long-term) R&D agenda should be defined in a collaborative process with local and external research and business partners. The success of that will depend on the extent in which the mutual trust will be further improved.

- *Annual budgeting vs. long-term goals:* Establishing a regional fund into which all stakeholders (may be also various foundations and even engaged public) could put funds devoted to the implementation of the strategy. This would become a truly sharing implementation procedure. Currently, individual projects are financed from the year to year which implies several technical problems to implementation. This change would also make the implementation more flexible in terms of strategic planning procedures (e.g. the time necessary for implementing the results of a program evaluation).

- *Innovation systems are borderless:* There is a potential for geographical extension of the South Moravian innovation strategy. However, existing administrative borders, resp. political mandate, pose a barrier to that. On the other hand, existing bottom up activities are borderless. Potentially, it can be talked about the Moravian innovation eco-system. In terms of manufacturing specialisation, there are several common strategic fields (e.g. machine tools, precise machining, mechatronic modules and components for various high-tech industries, precise measurement technologies etc.). Moreover, increasing intensity of R&D collaboration across regional borders is evident.

Lessons learned and conclusions for policy

The key lessons learned might be helpful primarily for the regions from other transitional economies that have been on the uneasy way towards a standard system of liberal democracy with market economy, and at the same time need to tackle with the global trend of shifting towards the networked knowledge economy.

- *The perspective and therefore ambitions must be global*: As science, technology and labour market for world class experts became global, only global ambitions can lead to sustainable success that makes a region attractive and helps to initiate a positive cumulative causality development (see Myrdal 1957).

- *Regional initiatives*: If the Region had waited for the support from the national level, only time and opportunities would have been lost. There have always been fundamental regional disparities in a variety of endogenous potential and development opportunities. It is only local efforts what can initiate a process of change.

- *Stakeholder's mobilisation*: Building the consensus space across regional triple helix sectors is both the first and the last objective of the day. It is not possible to obtain sufficient funds and achieve results without maximum energy devoted to negotiating and facilitating consensus approach of regional stakeholders.

- *Each region has its own way to find and utilize the potential for smart specialisation*: South Moravia is still at the beginning of the way, but none has better solutions compared with those which are selected on the basis of regional dialogue and capacities.

- *Combination of personal engagement and expertise:* There is a growing network of highly engaged individuals with high level of expertise in innovation systems and regional development across triple helix subjects. Such a group of people is seen crucial for the implementation process in terms of delivering true value for money. Expertise is necessary for technical capability for delivering the quality (achieving set targets efficiently). Personal engagement and motivations are fundamental for the functioning of the implementation system (e.g. avoiding of corruption, focus on consensus etc.). These are seen in South Moravia as essential preconditions of success, especially in the context of transitional countries in Central Europe, where the performance of public administration significantly lags behind the best scorers in the innovation scoreboards and, probably, the major difference in comparison with the innovation policy in the other Czech regions.

ESTONIAN RESEARCH AND INNOVATION STRATEGIES – THE ROADMAP TOWARDS A KNOWLEDGE BASED ECONOMY

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Regional, national and international policies that have been decisive for prioritisation of domains

Priority setting in the governance system

There are several important strategies which guide the research, development and innovation (RDI) in Estonia. Estonian Research and Development and Innovation Strategy (RDI Strategy) "Knowledge-Based Estonia 2007–2013" aims to enable sustainable development of the society by means of research and development, and innovation. It is tied to Estonia's long-term development strategy "Sustainable Estonia 21". The activities planned in the RDI strategy follow the "Estonian Action Plans for Growth and Jobs" approved by the Government of the Republic, Estonian Strategy for Competitiveness, The "Estonia 2020" competitiveness strategy and the "Estonian National Strategic Reference Framework 2007–2013". Other important area-specific development plans are "Estonian Higher Education Strategy 2006–2015", "Estonian Enterprise Policy 2007–2013", "Development Plan for Estonian Adult Education 2009-2013" and the "Estonian Information Society Development Plan until 2013".

Estonian RDI Strategy contributes to achievement of the goals of Estonia's long-term development strategies. The objectives of the RDI Strategy are implemented through horizontal (e.g. general broad-based) and vertical (e.g. focused on priority fields) activities. RDI Strategy directs public financial resources to horizontal activities on the basis of the following principles: preference is given to R&D with internationally competitive high quality; creation of preconditions for the RDI system to grow and be oriented towards efficiency, first of all creating a sustainable community of researchers and entrepreneurs and creating an attractive environment for research and development, and technological innovation; preference is given to R&D and innovation activities potentially creating high economic added value.

Vertical activities (e.g. priority fields), are supported through national R&D programmes. By their content, vertical activities are similar to horizontal ones, but they are focused on specific priority fields. At the same time, it is obvious that horizontal activities also significantly support vertical activities. Therefore, horizontal and vertical activities create synergy for implementing the objectives of the RDI Strategy. To encourage active participation by Estonian researchers and enterprises in international RDI cooperation, Estonia has also tried to bring the key areas in line with the European Union's RDI priorities. This has enabled for Estonia also to obtain additional financing for the achievement of national priorities.

Key policy instruments and investments

For supporting and funding the priority areas the national programmes in the key areas were initiated. National programmes in key technologies are meant to increase the capacity of Estonian research and development in the corresponding fields of technology and ensuring the distribution and implementation of key technologies in other sectors of economy (particularly in traditional industry, energy sector, transport, etc.) and socioeconomic fields (health care, life environment, etc.). There are six national R&D programmes launched, including sub-measures: *i)* Energy Technology Programme (2008-2013); *ii)*

Biotechnology Programme (2010-2013); *iii)* ICT Programme (2011-2015); *iv)* Health Care Programme (2011-2015); *v)* Environmental Protection and Technology Programme (2011-2015); and *vi)* Materials Technology open call (has started as provisional programme).

Additionally, the priority fields, like all the other, are financed through other instruments of the Estonian R&D funding system (institutional financing, baseline funding, research grant funding), and innovation and entrepreneurship policy instruments (e.g. R&D Financing Programme, SPINNO Programme, International Co-operation Networks, Technology Competence Centre Programme, Innovation vouchers, Cluster Programme etc.).

Coordination activities to support smart specialisation

There is a good tradition of collaborative RDI policy planning in Estonia, while the tradition for synchronised implementation and coordination of policies is not equally strong. Much of this task is coordinated through the Research and Development Council and its implementation falls under the responsibilities of sector ministries, in particular the Ministry of Education and Research (MER) and Ministry of Economic Affairs and Communications (MEAC). There are some problems in engaging other ministries and industry in the governance of the national innovation system in Estonia more actively, but this problem is tackled and is intended to be solved as soon as possible.

Measuring the effects and impacts

Policy design and evaluation is carried out, principally, by the MER and MEAC. The former is responsible for research and education policies, the financing and evaluation of research institutes and higher education institutions also coordination of international cooperation in research; the latter oversees support for and funding of industrial R&D, as well as planning, coordination and implementation of innovation policy. At the operational level, both ministries have implementing agencies/bodies and intermediaries, which are conducting the progress monitoring of various RDI support measures.

So far there have been key technologies as priorities and thereof the development of these technologies have been analysed in the past. Additionally to the regular measurement and progress monitoring there have been conducted also additional evaluations. For example in 2012 the National Audit Office analysed and evaluated the activities of the state in promoting key areas of research and development. In the same year was also carried through ERAC Peer-Review of the Estonian Research and Innovation System. In 2011 was carried through the mid-term evaluation of the implementation of measures in favour of R&D and higher education in the framework of the EU co-financed Structural Funds during the period 2007-13. In 2011 The Research and Innovation Policy Monitoring Programme (TIPS) has been commissioned by the Estonian Ministry of Education and Research. The programme provides high quality research competencies for policymaking and strategic development of Estonian research, development and innovation policy, and leads to future policy recommendations.

Future development for smart specialisation

Current status of the specialisation and prioritisation in the region

In current RDI strategy there are defined specific fields which have been prioritised by initiating and implementing national research and development programmes: *i)* to implement state-of-the-art technologies that provide high added value and the growth of productivity in many fields of life (information and communication technologies, biotechnologies, material technologies); *ii)* to solve socio-economic problems and to achieve socio-economic objectives in the areas that are important for every resident of Estonia, for instance in energy, national defence and security, health care and welfare services, environmental protection; and *iii)* to promote research related to ensuring the sustainability of Estonian national culture, language, history and nature and the Estonian state.

Ambitions, strategic plans and tools and catalysts in the innovation eco-system

In current process of policy and strategy planning the importance of S3 approach is recognised and the action plan for defining prioritised growth areas in Estonia is already established. The growth areas will be distinguished based on combined evaluation of structure of Estonian economy. During this evaluation, the research structure and industry structure in Estonia, resources of Estonia, and world megatrends are analysed. In planning and designing the future strategies different stakeholders are included – MER, MEAC, Estonian Development Fund, University of Tartu (TIPS programme) are the initiators of the analysis, but also other ministries, industry representatives, and research institutions are important contributors in the smart specialisation process of Estonia. For encouraging entrepreneurial discovery the cooperation and involvement of enterprises is thereat especially important.

Opportunities for cross-border and international eco-system development

Countries of the size of Estonia cannot effectively address all societal challenges alone, mostly due to the lack of critical mass and economies of scale. Many of the large societal challenges are universal, or at least European, and are therefore well-suited to be addressed jointly between the partners of European Research Area and with the support of European policies and measures for example through the Joint Programming Initiatives. This provides a clear argument for a continued strong Estonian cooperation and contribution within the European Research Area. This also means utilising the synergies and opportunities opening up within the Baltic Sea Region and Nordic countries. Also the mobility programmes and measures (e.g. Mobilitas, DoRa, Erasmus) are important in the international knowledge circulation.

Stakeholder and policy dialogues to achieve the ambitions

Estonian innovation policy is based on broad based collaboration led by the advisory Research and Development Council involving representatives of industry, academia, Government as well as ministries of Education and Research and Economic Affairs and Communications. In practice the main responsibility of strategy making, implementation and evaluation lies on the two ministries (MER and MEAC), while the content of the strategy is approved by the government and parliament. Both ministries have also committees on their own (research policy committee (MER) and innovation policy committee (MEAC) involving representatives of industry and academia and whose main task is to advise the ministers in matters of research and innovation policy. There is a definite need to strengthen ownership and implementation of national RDI programmes. Currently, there is a lack of clear “ownership” for the national RDI programmes, which makes their implementation challenging. In objective setting and administration of RDI programmes the sector ministries need to be more engaged and the objectives should engage all the players. The connection between sector ministries, societal stakeholders and the core RDI system should be much stronger in the future. One of the most critical aspects for successful smart specialisation is involvement of entrepreneurs.

Bottlenecks and threats for the innovation eco-system that hamper entrepreneurial discovery

The development and performance of the Estonian innovation system has been remarkable over the past two decades. On the other hand, Estonia’s innovation system is so far rather detached from a vast part of its economy. This is the result of the innovation system being focused on areas other than those that dominate the Estonian economy today.

Scarcity of skilled human resources is currently and likely to remain a bottleneck for sustaining the rapid growth of RDI in Estonia. Organic growth of resources is not enough in Estonia to respond to the needs of high growth sectors. The pool of RDI competent talent is small and easily absorbed by the needs of a few larger enterprises. Industry representatives have highlighted the lack of educated and skilled workers being a challenge for growth, and underlined that in some key areas in within the IT field there might be as little as two new PhD graduates per year. As a small country, it is unlikely that Estonia solves the talent challenge alone. Coordination is needed between economic, RDI, industrial, social and immigration policies. Strategies and measures are needed for improving Estonia's attractiveness in international race for competent skills. Continuing attention is needed on building attractive career conditions for both young and experienced researchers, as brain drain and attractiveness of research careers overall remain constant challenges (e.g. due to the low level of salaries).

There is also a need to strengthen ownership and implementation of national RDI programmes. Currently, there is a lack of clear 'ownership' for the national RDI programmes, which makes their implementation challenging. Sector ministries are not sufficiently engaged in objective setting and administration of RDI programmes. Ownership of the objectives is outside the research system, and objectives do not engage all the players. The connection between sector ministries, societal stakeholders and the core RDI system is insufficient. Also, the participation and activity of other stakeholders and societal partners (entrepreneurs, civil society organisations) in advisory bodies is low and thereby limiting the capability of advisory bodies and stakeholders to define the social demand for RDI policy.

There is a need to focus on fewer and stronger clusters. Particular emphasis should be paid on increasing the SME participation. There should be a stronger focus on building business driven clusters where all relevant research, education and technology institutions in a certain technology area or a certain scientific area should participate. More emphasis should be given to matchmaking activities between knowledge institutions and enterprises and not only on large R&D-collaboration projects with a limited number of enterprises.

Lessons learned and conclusions for policy

Lessons learned can be grouped as follows:

- *National programmes for key technologies*: The current national programmes for key technologies have proven to be both broad and challenging to implement in Estonia. The next RDI strategy could be more targeted and focus on more specific or fewer programmes with key importance. This would allow for better awareness, resourcing and coordination, with a higher probability for greater efficiency and effectiveness of measures as well. The smart specialisation approach is a good way to define the priority areas of Estonia.

- *Broad stakeholders' consultation*: One of the most important factors of the future development of innovation system and using smart specialisation approach is active involvement of different stakeholders. So far the involvement and coordination between different ministries and with industry has been an important problem. Cooperation between all the stakeholders has to be definitely increased in the future.

- *Social challenges*: It is highly likely that some key topics are of international relevance, such as responding to environmental and climate change, ageing of population, etc. In these topics Estonia should cooperate closely with the European, Nordic and Baltic Sea Region's developments.

- *Business involvement*: The absolute number of RDI performing companies is minimal in Estonia (~400 companies). This needs to be increased. Hence, more attention should be paid on reaching and engaging companies that are not yet performing RDI. This could be done, for example, by strengthening the cluster organisations' possibilities to finance and initiative projects with enterprises not having yet RDI activities. Furthermore, there is a need for employing a broader set of RDI policy instruments. This would mean including actions such as to support service innovation, technology transfer, IPR acquisition and protection, entrepreneurship, as well as process and organisational innovation. Also innovation in the public sector should be encouraged.

- *Public expenditure on RDI*: A growing share of the Estonian public expenditure on RDI has been coming from the European Union Structural Funds, which have helped a lot to improve the Estonian RDI infrastructure, human resource development and internationalisation activities. However, when the Structural Funds proportion becomes dominant, it does raise concerns with regard to the flexibility and continuity of the RDI funding in the long-term. Therefore it is important for Estonia to think about the ways of reducing the dependency from the European Union Structural Funds.

- *Place-based strategies*: The most evident and fundamental RDI framework factor in Estonia is its small size, which is directly reflected in the small number of companies, lack of economies of scale or critical mass in many areas of research and in particular, is evident in the availability of human resources, especially in knowledge intensive sectors. The mere fact of the size cannot be changed, but it is important to turn the small size into an advantage by being more focused and specialised in the future.

LATHI, FINLAND: FROM CLUSTER STRATEGY TO SMART SPECIALISATION

Raine Hermans, Director, Impact Analysis, TEKES National Technology Agency, Finland

Regional, national and international policies that have been decisive for prioritisation of domains

Priority setting in the governance system

The synchronization process of Finnish national and regional innovation strategies in year 2008 had the overall aim to increase the competitiveness of the Finnish economy. This involved goals of building a strong networked knowledge base; renewing the economy and creating new businesses; increasing productivity in industries and the service sector; enhancing wellbeing in society and improving environmental sustainability. Globalization was outlined as the key driver of change, transforming performance and value creation logics of national and regional value networks. It was concluded that critical mass should be situated in only a few multidisciplinary centres, simultaneously supporting the development of several specialized centres. The importance of utilizing complementary competences flexibly over borders in national collaboration was emphasized. In the Päijät-Häme (Lahti) Region case, the concern was to find the cross-cutting competences and industries that could create the most competitive value for a low level R&D activity area such as Lahti. The R&D input in Päijät-Häme Region is scarce, only about EUR 250 per resident.

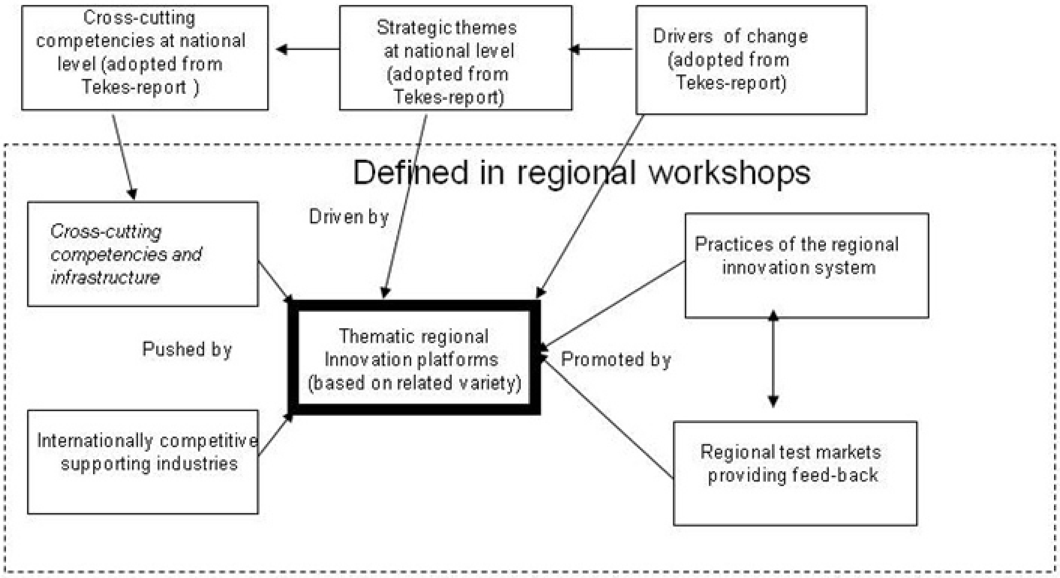
Key policy instruments and investments

In the synchronization process, national and regional innovation policy goals were harmonized, and nationally selected lead market areas were translated into the context of each region. A vertical link was formed between the National Innovation Strategy, the Ministry of Employment and Economy Corporate Strategy and Sectoral Strategies, the Tekes – the Finnish Funding Agency for Technology and Innovation Investment Strategy, and the Regional Innovation Strategies. The Tekes 2008 strategic focus area paper "People-Economy-Environment – Choices for building the future" represented the main linkage between regional and national strategies. The strategy paper was formulated through a broad-based process with over 5000 contributors from different sectors and regions. The paper outlines global drivers of change and current challenges of the Finnish economy and industries. In accordance, it presents eight national (lead market) themes and practices, as well as six cross-cutting competences and technologies for Finland. These choices were made to drive research, development and innovation activity to areas where Finland will have the best opportunities for growth and competitiveness globally.

Coordination activities to support S3

Based on the Tekes strategy paper and a literature review on the theories on international trade and innovation systems, a comprehensive framework was fused to evaluate all regional strategies, including Päijät-Häme (or Lahti region). This framework, consisting of the following elements, could be called the preliminary phase of smart specialisation: *i)* the internationally competitive industries of a region; *ii)* cross-cutting competencies and structures; *iii)* strategic lead market themes; *iv)* access to demanding test markets; and *v)* ways of action of innovation systems.

Figure 2.6. The framework used in regional workshops



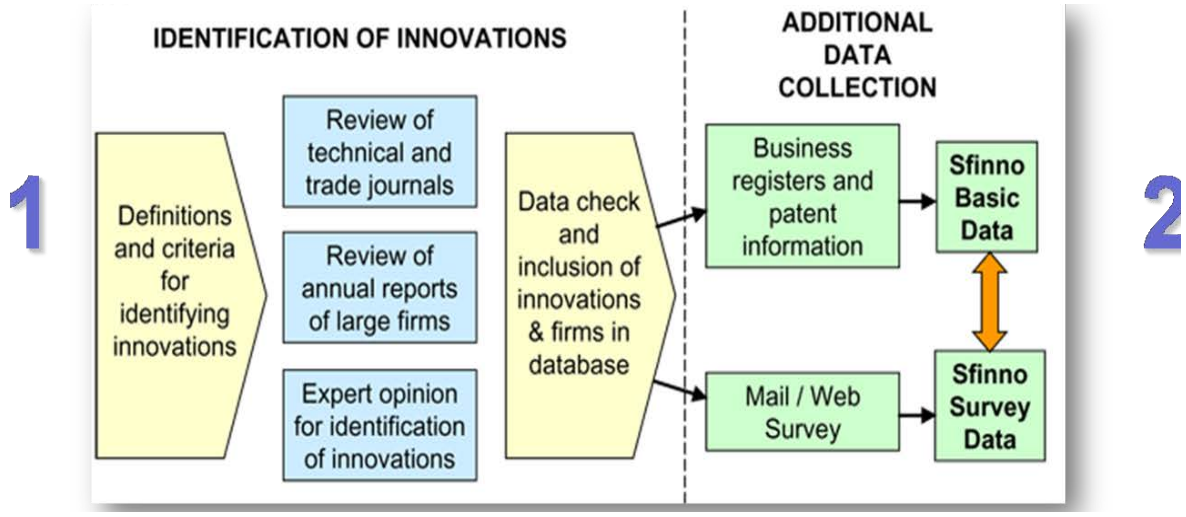
Source: Tekes

Empirical data -on how to articulate regional choices in terms of the national strategy- were collected in a series of 18 regional workshops, which were held during spring and autumn 2008 all over Finland. Each regional workshop had 15-20 participants representing organizations that had contributed significantly to the development and carrying out of regional strategies. They included regional authorities, representatives from universities, polytechnics and also private companies. Altogether almost 300 regional decision-makers participated in the workshops. During each workshop a regional strategy profile was synthesized using a developed framework and by answering the following questions. The results from Päijät-Häme workhop are revealed below where the workshop setting is described more thoroughly.

Measuring the effects and impacts

The Technical Research Centre of Finland, VTT has made a path-breaking research on the sources, nature and development of Finnish innovations. During the last 15 years the so-called SFINNO project has identified nearly 5 000 innovations and collected data on them. This database makes it possible to make versatile studies of the renewal of the Finnish economy and innovation environment. The study at hand represents pioneering work in the area of impact analysis in Finland. It is even internationally unique since the SFINNO database is significantly richer in content and wider in scope compared to other ones abroad. The SFINNO database consists of about 4 900 innovations developed by Finnish companies, dating back to 1 950. Update every other year by identifying innovations in field publications (See Figure 2.6). VTT updates the survey every other year by identifying innovations in economic and technical publications. This object-oriented approach is complemented by sending a questionnaire to the innovator. Based on the questionnaire, they defined typologies of different kind of innovations and linked individual innovations to actors in the Finnish innovation system. An innovation is defined here as a new product, service or method that produces economic or social benefit. The number and types of innovations in the marketplace will be followed in Lahti region and other regions utilizing the SFINNO database.

Figure 2.7. Finish Innovations, the VTT SFINNO Database



Source: Tekes. Futher information www.vt.fi/proj/shinno

Future development for smart specialisation

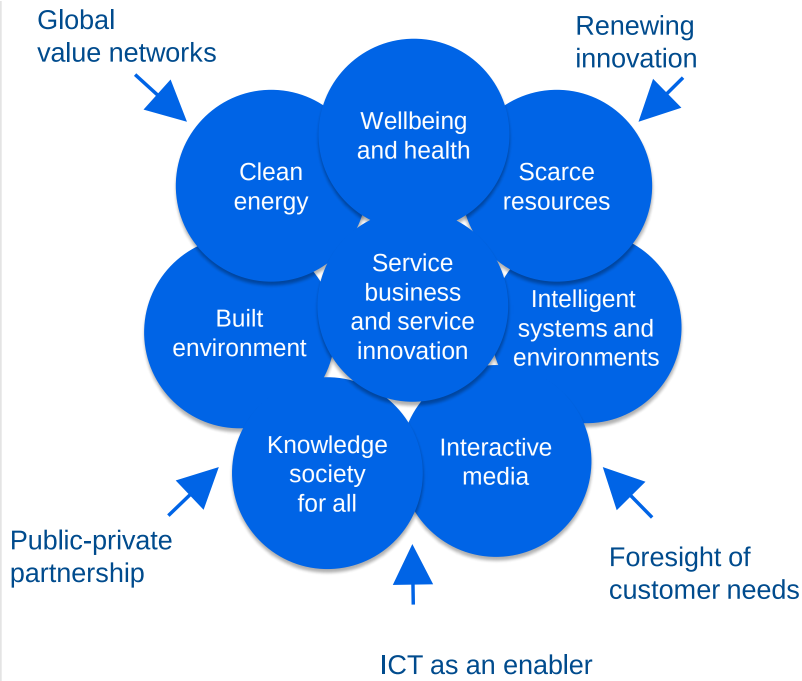
Current status of the specialisation and prioritisation in the region

For the past two decades, Päijät-Häme has been seen as declining industrial region relying on a tight cluster strategy and not having a university of its own. These characteristics have been reflected in weaker competitiveness and a lower level of education compared with the national level. On the other hand, they have, for example, provided the opportunity to create an entirely new way of implementing university policy through network-like operating models which focus specifically on research transfer, a key factor to this region. Tailored university expertise focuses specifically on the needs of its own region without fragmenting the university sector, and it can be tailored precisely to the needs of current business life without requiring the entire university sector to change.

In the Päijät-Häme case, the combination of inefficiency caused by the isolating nature of the cluster strategy and low R&D input eventually led to a new action model in the region that might be described as a form of Smart Specialisation. It comprises understanding of the wide range of innovation as well as concentration on practice-based (not scientific-based) innovation in particular and the spearheads of expertise serving all industries and clusters, namely environment, design and practice-based innovation. This model of thought enabled the collaboration of all the strategies, plans and bodies in the region. Päijät-Häme has outlined competitive industries, core cross-cutting competences and strategic lead-market themes for the development of its innovation ecosystem and industrial outlook in the future. Through these choices, the region aims to lift its competitiveness to a global level. According to the specialisation index, Päijät-Häme is specialized in manufacturing machine tools, plywood and timber plates, sportswear, car parts and engines manufacturing, clothing and accessories, and furniture manufacturing.

Since the industry structure is skewed to low-technology industries, the potential lies in ability to renewal based on the ability to utilize cross-disciplinary competences and identification of changes in lead markets. The region’s spearhead competences are: Wide-ranging environmental expertise; Metal and mechatronics expertise; Expertise associated with digital contents and e-learning; Food processing expertise; Expertise in industrial design; Skills in practical innovation activities. Focal lead market themes were identified based on broader national themes outlined by Tekes in its strategy paper in 2008: *i)* Water purification and distribution; *ii)* Scarce resources and energy efficient solutions; *iii)* Welfare and health promoting services, equipment and nutrition; *iv)* Timber built environments and scarce resources in housing; and *iv)* Design services.

Figure 2.8. National (Lead Market) Themes and Practices in 2008-2010



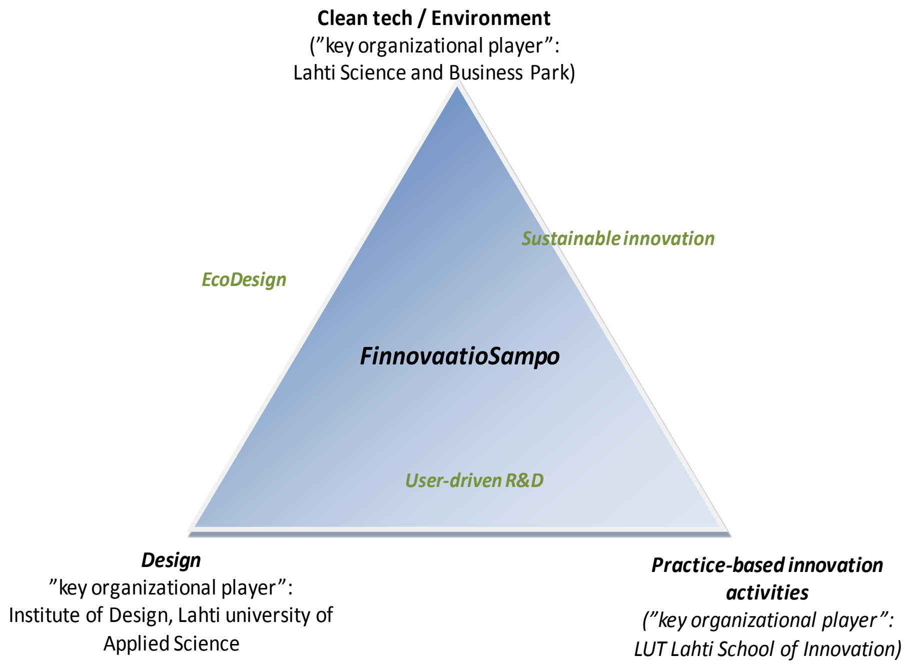
Source: Tekes

Ambitions, strategic plans and tools and catalysts in the innovation eco-system

Three thematic top expertise areas were selected by the bodies in Päijät-Häme region as regional platform of practices in a regional innovation system, which are based on cross-cutting competences, lead market themes, supporting industries and demanding test markets. The three chosen top areas of expertise are the environment, design and practice-based innovation. The regional bodies of Päijät-Häme are generating a new, internationally high quality network of R&D and innovation, a ’meta platform’ that will combine the three expertise areas with the regionally strong clusters and industries in a unique way. It will help to identify innovative business potential in border-crossing expertise areas and industries. The framework of the platform is presented in Figure 2.8.

The concept is based on five premises: *i)* Companies, research institutions, development organizations and users form a platform and collaborate around a common issue, a so-called hotspot; *ii)* The focus is on the phases of testing, piloting and prototyping; *iii)* Creative combinations crossing borders of industries and sectors will be implemented in innovation; *iv)* The actions are user-driven, the customer is a subject in the innovation process; and *v)* Environmental expertise, design and innovation expertise will form a novel combination.

Figure 2.9. Framework of the national and regional platform



Source: Tekes

Opportunities for cross-border and international eco-system development

The Lahti region has developed specific innovation activities, which aim to ease access to international markets and develop regional cross-border practices. Methods for supporting the internationalization and user-driven innovation capabilities of companies in the region – access to demanding test beds: *i)* a special user-driven model of action for R&D and innovation has been developed in the Lahti region, deriving from the needs of companies. The strengths characteristic for it are a fast application and commercialization of ideas as well as efficient means to attract international expertise to support the development. The companies in the region have successfully applied this action in their own businesses. Lappeenranta University of Technology Lahti School of Innovation hosts a research team which is the leader in Finland in innovation environment research. The team has also participated in the practical testing and developing of the model; and *ii)* the technology bank provides an access to the global value chain. Since technology is getting more complex, it is crucially import for the SMEs to access to more and more background technology. Technology bank concept provides an access a group of related technologies through one license. Assemblies by product area or technology area generates a potential to understand latest technologies and provides potential to license patents and get access to technologies of large multinational enterprises. In many cases, the large enterprises are interested in buying or licensing the technologies that are developed further by the SMEs.

Core practices for promoting and facilitating innovation activities in the region have been established. These focus on, for instance, renewing current processes; creating methods for anticipating user needs; promoting public and private sector partnership and cooperation (including knowledge transfer and cooperation between research organizations and other organizations); facilitating the creation of global value networks facilitated; enhancing the effective use of ICT in the innovation system.

Stakeholder and policy dialogues to achieve the ambitions

Interactions between government and cluster organisations (regional, national, international) are crucial. In this sense, the strategy synchronization process between Tekes and regional stakeholders has involved: *i)* Regional government: Lahti city authorities; *ii)* National stakeholders: OSKE program on environment. Tekes as a national R&D funder; *iii)* EU's smart specialisation agenda; and *iv)* Industry: individual companies, chamber of commerce.

Bottlenecks and threats for the innovation eco-system that hamper entrepreneurial discovery

Low R&D levels in all sectors remain a key bottleneck for the region. In addition, few financing channels with risk-taking capabilities exist. The overall innovation service network and innovation infrastructure remain obscure. Finally, Lahti needs to link vocational education to the development of the innovation environment and increase international education and research cooperation.

Lessons earned and conclusions for policy

The lessons learned can be grouped as follows:

- *Abandonment of the strategic cluster emphasis:* the first phase of Smart Specialisation consisted of the abandonment of the strategic cluster emphasis.

- *Experimentation:* the strategic combination of the new practice-based innovation philosophy with the top three areas of expertise led to a novel innovation environment, that could, perhaps, be renamed a preliminary phase of Smart Specialisation.

- *The role of innovation in each region:* the Lahti example indicates that also a region poor in research and development resources may show a great proportion of innovativeness. The number of innovation in Finnish regions related to their added value by 2007, showing Päijät-Häme relatively the most innovative regions in Finland despite very low research input.

GERMANY: JOINT INNOVATION STRATEGY OF THE STATES OF BERLIN AND BRANDENBURG (INNOBB)

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Regional, national and international policies that have been decisive for prioritisation of domains

Priority setting in the governance system

Brandenburg and Berlin form together the German Capital Region. With around six million inhabitants and an area of over 30 000 km² the region presents high growth potentials. The state governments of Berlin and Brandenburg came in August 2006 to an understanding about a common model called "Capital Region Berlin-Brandenburg". The model is the result of a broad social dialog, in which a lot of citizens, associations, municipalities and politicians were involved. With this model both States agreed on a common development strategy.

Following this first step to the elaboration of a Smart Specialisation Strategy, Brandenburg and Berlin went on, during innovation summits and thanks to SWOT analyses, with the preparation of a S^3 in the field of innovation policy. Based on two regional innovation strategies (the "Land Brandenburg innovation concept 2006" and Berlin's "Coherent innovation strategy"), the results of the 2008, 2009 and 2010 innovation summits, and the current financing and transfer agreements, both States have been developing, since 2007, a Joint innovation Strategy, innoBB, focused on five clusters: Healthcare, Energy technology, Transport, mobility and logistics, ICT/Media/creative industry and Optics. The innovative core of the nascent cluster structures is underpinned with a growth-and competition-oriented basis by innovation policy instruments. In this sense the joint innovation strategy with its main objective of securing the capital region's international competitiveness also falls in line with the "Europe 2020 Strategy" as the States' specific contribution to intelligent, sustainable and integrative growth.

Based on the SWOT analyses as well as the economic and innovation development of the past few years, spheres of activity ("Handlungsfelder") have been defined for each cluster. These spheres have then been discussed with the scientific community and the enterprises: during "Handlungsfeldkonferenzen" (separate conferences dedicated to each sphere of activity), every actor of the cluster had the possibility to give its opinion on the cluster construction and to notify its priorities.

Key policy instruments and investments

The innoBB approach concentrates on industries that are characterized by having a critical mass of actors with joint interests in markets with big growth potential on an international scale. Key targets are the development of innovative products by know-how and technology transfer from the excellent academic institutions, the creation of new companies, the expansion of cooperative projects, a better resource deployment and a more effective market penetration.

To meet these goals in the previous years, both States created parallel funding schemes to support R&D projects as well as contract research by regional institutes for regional companies. 80% of the funding in these programs is given to companies that belong to the five clusters of the joint innovation strategy. In addition to that there are extensive services offered by the cluster management organisations, e.g. support for scientists and new companies in networking, searching for partners, technology transfer, founding, financing, advanced training, business development and internationalisation as well as the initiation and realisation of joint R&D projects. Both States also have technology centres and business incubators, offering support for start-up companies through offices at favourable prices, know-how transfer, etc. Moreover there are venture capital funds managed by subsidiaries of the developments banks of both Berlin and Brandenburg, which are crucial for providing seed finance for young innovative companies. Another initiative of both States is the common Business Plan Competition. Thanks to know-how transfer, coaching, networking and competition, the “entrepreneurs to be” are supported through the transformation of their idea into a commercial concept.

Coordination activities to support S3

The main politics issue resulting from a common inter-regional strategy might be the necessary agreement on the other policies linked to the innovation strategies, e.g. some of the funding schemes. If the promotion of joint projects is to be improved, the provision of attuned/coordinated innovation promotion instruments is an essential requirement for the realisation of innovations and hence exerts a direct influence on the innovation dynamics of the capital region. Within the implementation of innoBB on the cross-border level, both States are equally represented at the political and administrative levels. Representatives of the innovation and economic development agencies of Brandenburg and Berlin form the Cluster managements and coordinate the funding and support activities. In order to foster the connection between the different clusters as well as to optimise the measures and activities which are to be implemented in every cluster (e.g. marketing issues, cross-cluster projects), representatives of the cluster managements meet on a regularly basis and report the issues and requests of their members to the political and administrative decision bodies.

Measuring the effects and impacts

The criteria for the impact measurement will have to be placed on each level of innoBB implementation. Each cluster has to define indicators that will allow evaluating its work and progress. The interconnection between the different clusters will be evaluated through the implementation of common pilot projects as well as through the consideration of cross-cutting themes. The issues discussed during the steering groups as well as the involvement of the cluster (Are there issues taken into account? How fast? Are existing funding schemes adapted to the cluster strategy? Are there indicators of the efficiency of the bottom-up process?) Examples of indicators set-up by the clusters are: industry settlement, job creation, investment, patents, and new products, visibility on the national and international level.

Future development grasping the opportunities for smart specialisation

Current status of the specialisation and prioritisation in the region

The current status of the specialisation and prioritisation in the region can be grouped as follows:

- *Healthcare:* Companies in the biotechnology, medical engineering and pharmaceutical industries form the innovative core of the “healthcare industry´” cluster which also includes health-related services. The expansion of the cluster is to create new jobs by way of the continuous further development of the innovative core, such as, for example, medical imaging, regenerative medicine and diagnostics as well as by locating companies locally.

- *Energy Technology:* The capital region holds a leading position within Germany in research and development, but also in the production and application of environment-friendly energy and cutting-edge energy efficiency technologies. Brandenburg is currently witnessing the construction of the world's largest biogas facility and the largest onshore wind power station. In Berlin, energy efficiency in the building sector is outstandingly positioned in a nationwide comparison. Future-oriented power engineering topics such as energy storage have also been actively taken up in the capital region.

- *Transport, Mobility and Logistics:* The cluster development entails a further strategic merging of competences and the building up of cross-border synergies in the interrelated fields of activity of road traffic/automotive, rail technology, traffic telematics, aviation and space flight, as well as logistics. The capital region traditionally offers high competence along the entire value creation chain with the presence of renowned manufacturers, service providers, and a broad range of science and research facilities.

- *ICT, Media and Creative Industries:* The spectrum of the cluster ranges from international companies in the film industry, the creative sector and e-businesses through to data processing and telecommunication technologies. The developments in the ICT industry frequently serve as initial forerunners for innovations in other clusters.

- *Optics:* In Berlin and Brandenburg the optics cluster involves the entire value creation chain and various application areas in optical technology and the closely related microsystems technology. To promote the development of this cluster, six fields of activity were identified: Optical technologies in biomedicine and pharmaceuticals, laser technology, lighting technology, optical measurement technology and sensors, optical communications technology, microsystems engineering.

Ambitions, strategic plans and tools and catalysts in the innovation eco-system

The capital region's higher education and science landscape is multifaceted and unique. A close dialogue between science and industry promotes the dynamics of innovation and activates the existing research and development potentials by way of corresponding transfer approaches and collaborative projects. Within the clusters the cooperation of the companies can be amplified along the value creation chains, and gaps can be closed. The improved opportunities for system offers serve to enhance the competitive position of the cluster partners. Small and medium-sized companies, in particular, can put their resources to optimal use by taking part in a cluster, benefit from an improved division of labour or supply situation within a cluster, and are hence able to focus on their respective core competences. The competence and reach of a cluster is systematically expanded in parallel to its growth process. Clusters can therefore enable companies to open up new markets and achieve international visibility more quickly.

Regional commonalities such as the locally available personnel and their qualifications or the science and transfer offers available create improved conditions for joint projects that will also hold their own position in an international competition. A professional management will ultimately ensure that the cooperation and project structures within a cluster are expanded strategically, while supporting the development and coordination of joint and assisted cross-border projects. The focus of the further development process lies on highly participative approaches for involving the actors in the clusters. Additionally required is the elaboration and/or updating of master plans for clusters, complete with the interfaces to the cross-cutting themes. The master plans include: *i)* Unambiguous and measurable strategic development targets for each cluster, including a strategy in the sense of a clear definition of potentials, as well as of fields of activity for their implementation; and *ii)* Individual pilot projects which are attuned to this and prioritized for implementation.

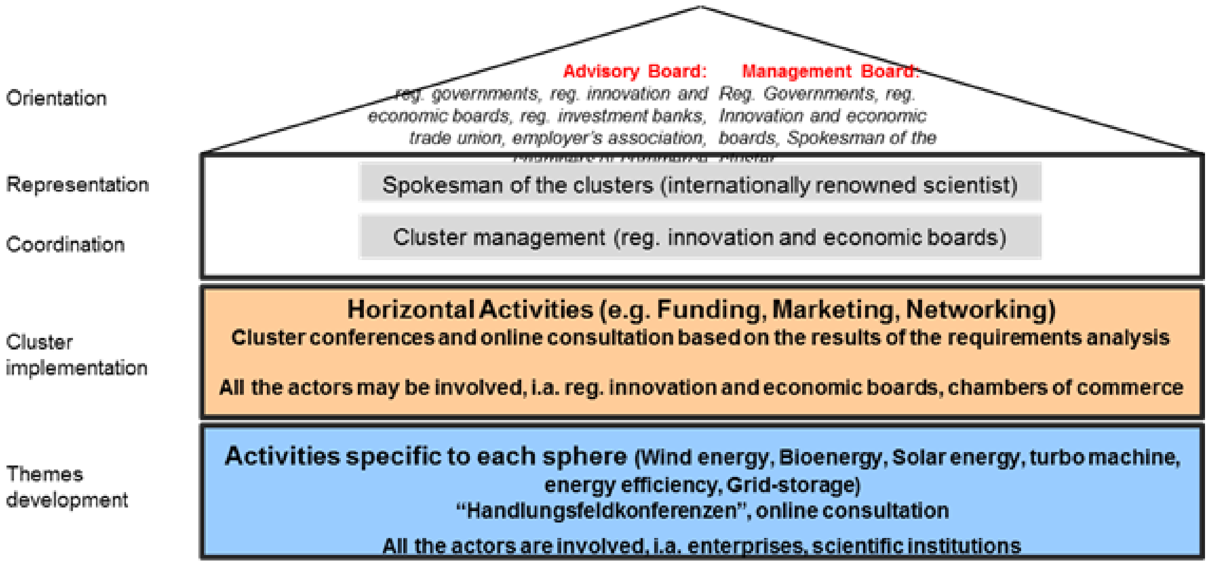
Opportunities for cross-border and international eco-system development

Supporting the private and science sector of the capital region in the enhancement of their international competitiveness is a central objective of the innovation strategy. The companies and research facilities of the capital region already entertain a multitude of international contacts and cooperation relationships today. Building on this, the clusters will develop systematic network relationships and strategic partnerships with both individual companies and cluster organisations from Europe and beyond. An important tool for this is the involvement of international partners in cluster projects. An analysis of the status quo of the internationalisation within the clusters has been made during their creation phase. In parallel, some of the clusters implemented benchmarking activities. Following these activities each cluster agreed (within a working group composed of representatives of networks, industry, sciences and administration) on the proposed measures they wanted to implement in the future, for example, the participation in international trade fairs, cluster cooperation on the international level and initiation of European research projects.

Stakeholder and policy dialogues to achieve the ambitions

Stakeholder's involvements during the policy-making can be exemplified with the following figure refereed to the cluster for energy technology:

Figure 2.10. Stakeholders' involvement at different levels



Source: Brandenburg

Bottlenecks and threats for the innovation eco-system that hamper entrepreneurial discovery

The capital region hosts many internationally renowned universities as well as research institutes (such as Fraunhofer and Max Planck institutes). One of the big challenges is the commercial exploitation of this immense potential for innovative products. The economic landscape of Berlin and Brandenburg is mainly composed by SMEs. Only very few headquarters of big companies are located in the region, so that often the research and development activities of these companies don't take place in the capital region. But R&D co-operations, strategic alliances and acquisitions offer the chance to connect big international corporations to the region. The availability of venture capital in the region is rather limited. In order to attract international VC investors Berlin-Brandenburg has to present itself as the open, vibrant and innovative city it actually is. Especially in the field of media and creative industries this strategy seems to work. Regional instruments for early stage funding for the commercialisation of research results are also necessary and have shown to be useful.

Lessons learned and conclusions for policy

Looking back at three years of analysing, planning and finally implementing the joint innovation strategy and the corresponding cluster structures three points have become clear.

- *Cross-borders perspective:* in order to compete internationally a trans-regional perspective is indispensable. This starts with Berlin and Brandenburg joining forces and has to proceed with the establishment of extensive international networks. Due to its high international visibility and its attractiveness as a place to live for people from all over the world Berlin-Brandenburg has very good chances to further expand its links to other regions with similar or complementary strengths in Europe and worldwide.

- *Entrepreneurial success involves much more than science and technology:* Berlin-Brandenburg has very strong research organizations. But it still has to improve upon the launching and fostering of new business activities on the basis of the research findings. Therefore technology transfer is crucial for the success of the cluster strategy. Having defined the five clusters it has also become clear that there is a big potential for cross-sectoral co-operation through joint activities by members of two or more clusters, for instance in the fields of health-IT, laser medicine, or electro mobility.

- *Clusters concentrations:* although Berlin and Brandenburg have concentrated on only 5 sectors, the clusters are rather broad and consist of both innovative fields with high growth potential and rather traditional fields which are less R&D- and more service-oriented. The activities of the cluster management have to focus on the smaller innovative cores, where the close cooperation of academic institutions and enterprises gives the opportunity for sustainable growth. It seems to be useful for the development of the region to put special emphasizes on smaller but more numerous niche markets (e.g. diagnostics or telemedicine) within the clusters.

MAŁOPOLSKA REGION, POLAND: PRIORITY SETTING AND GOVERNANCE FOR SMART SPECIALISATION

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Regional, national and international policies that have been decisive for prioritisation of domains

Priority setting in the governance system

Over the last 20 years the governance system of the Małopolska Region has been shaped by: *i)* the decentralization of public administration, e.g. creation of multi-level governance system with *gminas* (1990), districts and regions (1999); *ii)* the establishment and development of regional strategic management system, including the preparation and implementation of regional strategic documents (*e.g.* Regional Development Strategies and Regional Innovation Strategies); and *iii)* the increasing interaction between regional, national as well as European levels, especially in terms of implementing EU structural funds (one of the main source of funding for regional innovation policy instruments).

Both at the national and regional levels the role of defining priorities for science and innovation policies has increased over the last years, mainly due to foresight activities. The first national foresight programme started in 2004 as a pilot project concerning health and life issues. Thereafter, foresight activities have been carried out systematically at the national level, e.g. the National Foresight Programme Poland 2020 (2006-2009) and the project Insight 2030 (2010-2011). The results of the National Foresight Programme Poland 2020 were incorporated in the National Research Programme (2011), which includes 7 strategic, interdisciplinary directions of research and development activities such as: energy, health, ICT, new materials, environment and agriculture, society in sustainable socio-economic development, safety and defence. The results of foresight projects have also been included in the *Strategy for Innovation and Efficiency of the Economy. Dynamic Poland 2020*.

The first regional foresight project (*The technological foresight for sustainable development of the Małopolska Region*) was carried out in 2006-2008. The project was based on more horizontal approach (the key areas were: economic growth, infrastructure, natural resources and new materials). The second regional foresight project (*The Technology Perspective Kraków-Małopolska 2020*[35]) was carried out in 2010-2011. Under the project 10 key technologies for future development of regional economy have been defined. The ten most promising technologies in terms of the regional potential have been grouped into three areas: *i)* safety and comfort of living: energetically self-sufficient construction, clean energy technologies as well as material engineering and nanotechnology for special use; *ii)* medicine and health: tissue engineering, drugs and technologies locally destroying cancer, monitoring and control of medical conditions and streamlining of the healing process based on the data analysis; and *iii)* information and visualization: touchless computer interface, intelligent systems and universal access to information.

These key technologies were incorporated in the updated regional development strategy - *the Development Strategy of the Małopolska Region 2011-2020*. The process of updating the regional development strategy took over 2 years of thorough cooperative works involving many actors, including experts and citizens. At the moment all regional policy strategic documents are being updated to be in line with the superior *the Development Strategy of the Małopolska Region 2011-2020*. Among them there is *the Regional Innovation Strategy of the Małopolska Region for 2013-2020 (RIS 2013-2020),* which define more precisely the guidelines, and priorities of *the Development Strategy* with regard to innovation and entrepreneurship (in line with *RIS 3 Guide: Guide to Research and Innovation Strategies for Smart Specialisation (RIS 3)*).

Key policy instruments and investments

The key policy instruments implemented by the regional authority are:

- The Małopolska Regional Operational Programme 2007-2013 (EU Cohesion Funds for 2007-2013):

  - The Priority Axis 1 of the Programme, which aims to improve access to education and development of information society. The funding is directed to investments in education infrastructure, life-long education infrastructure as well as investments in infrastructure and technology with a view to developing information society. The majority of the R&D projects financed under the Priority are in three fields: ICT, chemicals and medicine.

  - The Priority Axis 2 of the Programme, which aims to direct investment-related support for SMEs and strengthening of their institutional environment and support for commercialisation of research. In particular the founding is directed to investments in industrial research performed by research units for entrepreneurs; investment projects in the form of tangible assets provided for the purpose of conducting R&D works in enterprises; innovative solutions by providing financial assistance to pre-competitive research in enterprises.

  - The Priority Axis 5 of the Programme, which includes also support for activities involving the cooperation of research centres, in particular for the Małopolska innovation centre; and activities enhancing the cooperation among research centres, including the system of investment grants, aimed at supporting the development of the Małopolska innovation centre.

- The Special Economic Zone in Kraków (SEZ), which is managed by Technology Park Kraków. SEZ is designed for all businesses from industry and services, but there are some preferences to companies from industries, mainly automotive or services like ICT, R&D, financial and accounting services (BPO). The strategy of SEZ as well as Technology Park Kraków is to focus the activity on ICT industry. The two projects managed by Technology Park Kraków, which are aimed to strengthen regional specialisation in ICT, are: the development of ICT Technology Incubator (established in 2008) and the Małopolska IT Park (the project will be finished in 2012 and is financed from the Operational Programme Innovative Economy).

Coordination activities to support smart specialisation

Overall coordination activities have been carried out by the regional authorities of the Małopolska Region. The Regional authorities established a special working group consisting of science, business and government experts to prepare *RIS 2013-2020 (the group has been supported by national government experts)*. The working group has organised many meetings dedicated to specific issues of *RIS 2013-2020,* such as: SWOT analysis, the areas of specialisation in line with RIS 3 Guide, monitoring and evaluation systems, the role of networks and cooperation with other regions. All the outcomes of the working group have been step by step presented and discussed on the forum of key regional councils and advisory bodies such as: the Małopolska Innovation Council (advisory body for innovation policy) the Małopolska Economic Council (representation of high-level regional experts from business), Joint Commission of

Territorial and Economic Self-government of the Małopolska Region (regional consultative and advisory body), the Małopolska Information Society Council (advisory body for information society area).

Measuring the effects and impacts

Measuring the effects and impacts of policies at regional level is carried out by the Małopolska Regional Development Observatories[36]. These are four observatories: *i)* Małopolska Development Policy Observatory which concentrates on the impact of the European Union funds on sustainable development of the region, on development of selected sectors of regional activity as well as their impact on the implementation of the Region Development Strategies; *ii)* Małopolska Economic Observatory which monitors the state of Małopolska economy; *iii)* Małopolska Social Policy Observatory which monitors and collects the data from the area of social policy; and *iv)* Labour Market and Education Observatory of Małopolska which focuses on gathering information and improving knowledge of the regional labour market and education.

At the same time, the system of monitoring and evaluation of *Regional Innovation Strategy of the Małopolska Region 2008-2013* has been developed. The system is based mainly on the indicators related to activities of regional stakeholders (if any phenomenon occurs interesting or alarming it goes under separate insight examination and evaluation). The system is going to be continued and improved under *RIS 2013-2020*). The outcomes of the monitoring processes are taken into account in preparing regional strategic documents.

Future development for smart specialisation

Current status of the specialisation and prioritisation in the region

The regional economy has undergone many structural changes over the last 20 years, especially from low-tech manufacturing industries to medium-tech manufacturing industries and knowledge-based services. The examples of the structural changes taking place in the Małopolska Region are presented in Table 2.1.

Table 2.1. The examples of structural changes in the Małopolska Region

Model of structural changes	Examples of the Małopolska Region
Transition	A transition from agro, food industry and chemistry to plastics, cosmetics and life sciences. The transition is based on the potential of regional industrial and science base. Another example is salt mine in Wieliczka which has changed the profile from salt mining to new fields like tourism, museum and health activities.
Modernisation	Foundry industry (mainly SMEs) and steel industry (in both cases, the implementation and exploitation of ICT and nanotechnologies), mining and energy (e.g. clean coal technologies, ICT). The modernization is based on industrial and R&D capabilities.
Diversification	The activities of MNEs, which located production elements of their value chains in the Małopolska Region, and then established additional activities like financial services (*e.g.* EDF which took over electricity producers in Małopolska and then located in Małopolska the centre of common services).
Radical foundation of new domains	The emergence and growth of ICT industry.

Source: Marshal Office of the Małopolska Region, MSHE

Ambitions, strategic plans and tools and catalysts in the innovation eco-system

The Małopolska Region is currently at the process of updating *RIS 2013-2020*. The goal of this process is to give new impetus for the regional innovation system by: *i)* concentration of public funding (top-down initiatives) on key areas for future development such as: life science, sustainable energy, information and communication technologies (including multimedia), chemistry; *ii)* emphasis on three flagship undertakings: *a)* support for entrepreneurship of higher-education students and academics; *b)* common innovation bonds (new instrument encouraging to test ideas at early stage); *c)* systems for multi-channel information and service provision (ICT solutions); and *iii)* gathering the most interesting proposals of innovation projects (bottom-up initiatives) that are in line with key areas for future development and could be implemented by 2020.

Opportunities for cross-border and international eco-system development

The main drivers of cross-border and international eco-system development include: building R&D networks, developing clusters and clusters' cooperation as well as supporting the internationalisation of companies. The examples include:

- *The CC PolandPlus Kraków*[37] (European R&D network) which is a part of the KIC InnoEnergy Initiative. The CC PolandPlus Kraków is concentrated on developing Clean Carbon Technologies and New Paradigm for Carbon Management. The coordinator of the project is the AGH University of Science and Technology in Kraków. The partners of the project are from the neighbouring Region of Silesia. The main task of the project is to develop new methods of cleaner energy production from already existing sources, and the acquisition of new renewable energy sources.

- *The LifeScience Cluster in Kraków* (cluster) is a network of institutions from the Małopolska Region, representing six areas of interests: business, business support, R&D, education, healthcare and government. The LifeScience Cluster in Kraków was established in October 2006 as collaborative project of 32 institutions, including the Jagiellonian University, the University of Agriculture in Kraków and the first technology park dedicated to life science in Central and Eastern Europe. One of the objectives of the LifeScience Cluster in Kraków is to enable effective global connectivity and optimization of existing potential of individuals and organizations. The LifeScience Cluster in Kraków cooperates with:

  – *Genopol Evry* in France (since 2008, a cooperation agreement to jointly manage development projects, finance and commercialize research),

  – *Global Innovation Network* (since May 2009, acting for the regional development of biotechnology and life science sectors),

  – *European Diagnostic Cluster Alliance* (support of the development of medical diagnostics through a cooperation network of major European centres).

- *The Multimedia and Information System Cluster in Nowy Sącz* (cluster), which is an inter-regional network of collaboration created at the initiative of the Nowy Sącz Business School – National Louis University and medium-sized enterprises predominantly from the regions of Małopolska, Silesia and Mazovia. The MultiKlaster was established in 2006. Now, the MultiKlaster groups television and film studios, producers and suppliers of mobile solutions, software for companies, advanced internet applications as well as interactive marketing agencies.

- *ICT companies: Comarch Group and Ericpol Telecom.* Comarch Group, which was established in Kraków in 1993, has built an international network of subsidiaries and offices throughout the USA, Europe and the Middle East. Ericpol Telecom (Ericpol) was established in 1991 in Łódź, but since 1995 the company has also operated in the Małopolska Region. The Ericpol structure includes subsidiaries in Sweden, Ukraine and Belarus. Both companies cooperate with regional universities e.g. the Jagiellonian University, the AGH University of Science and Technology, and the Cracow University of Technology. Besides, *onet.pl*, and *interia.pl* have their headquarters in the Małopolska Region (onet.pl is the biggest Polish webportal; interia.pl holds third place in Poland). World ICT leaders are also represented in the Małopolska Region by e.g. Cisco, Google, Motorola (R&D centre), IBM (R&D centre), HP, Delphi (R&D centre).

Stakeholder and policy dialogues to achieve the ambitions

One of the main goals of the regional authorities of the Małopolska Region is to engage citizens, especially scientists, students and entrepreneurs in the process of preparing and implementing *RIS 2013-2020*. The Marshal Office of the Małopolska Region delivers analytical and organisational support. Information about *RIS 2013-2020* was put into local and regional newspapers as well as via Internet. The process of public consultations has been divided into many phases. The first public consultations were about the goals and vision of the future of the Małopolska Region; the second consultations are going to be about instruments. The goal of this approach is to involve stakeholders from a very early stage of preparation of *RIS 2013-2020*.

Bottlenecks and threats for the innovation eco-system that hamper entrepreneurial discovery

Many specific recommendations have been formulated during the work on *RIS 2013-2020*. Stakeholders indicate the need to put more efforts on concentration of research and innovation priorities, mainly on the areas such as life science, ICT, energy. There is also a need to overcome fragmentation and increase the effectiveness of public support (support for a lower number of projects, stimulating demand and strengthening bottom-up initiatives) and its better link with funding offered at European and national levels.

Lessons learned and conclusions for policy

The lessons learned can be grouped as follows:

- *The role of universities in supporting transformation of regional economy:* The example shows that important role in transformation of regional economy has been played by regional universities, especially in the fields such as: ICT, multimedia and life sciences. Regional universities are also engaged in many initiatives aimed at addressing the main challenges in traditional areas of regional specialisation i.e. mining (clean coal technologies) or chemistry, foundry and steel industries (new materials, ICT).

- *The role of foresight, monitoring and evaluation system in the priority setting*: The example of the Małopolska Region shows that the setting of research and innovation priorities is a challenging task including many stakeholders and active role of the regional authority. To define research and innovation priorities, the results of foresight activities could be used, but these results should be discussed with stakeholders through public consultations. Another challenge is how to engage stakeholders in the process of implementation of *RIS 2013-2020*. It seems that monitoring and evaluation system (i.e. the Małopolska Regional Development Observatories, and constantly developed system of monitoring and evaluation of RIS 2008-2013) could be actively used in this field through promoting transparency and effects of public interventions.

- *Thematic concentration*: This example shows also that the thematic concentration could help to optimize the synergies between different levels of research and innovation funding (European, national and regional). For example, the development of sustainable energy in the Małopolska Region is one of the key areas for future development identified by regional foresight and regional stakeholders, but it is also the area supported through the instruments implemented at European level (e.g. the CC PolandPlus Kraków) and national level (e.g. the National Research Programme). Other examples of the areas of thematic concentration in the Małpolska Region, which could take advantage of complementarities and synergies of multi-level governance system, are: life science, ICT and multimedia, chemistry.

NOTES

35 More information about the project: *http://foresight.kpt.krakow.pl/en*

36 *www.obserwatoria.malopolska.pl/pl/maopolska-regional-development-observatories*

37 *www.kic-innoenergy.com/co-locations/cc-poland-plus.html*

BASQUE COUNTRY, SPAIN: SMART SPECIALISATION STRATEGIES

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Regional, National and International Policies that have been decisive for prioritisation of domains

Governance System

From the point of view of political governance, it is clear in the case of the Basque Country Autonomous Community (Comunidad Autónoma del País Vasco) that effective leadership in setting of priorities for research and innovation policies lies basically with the Basque government. This is based primarily on the particular political configuration of the Basque region's autonomous structure, in which the Basque government has core competencies in the field of industrial policy and essential management competences education, reinforced recently by the transfer to the Basque government of competencies in R&D. On the other hand - it is peculiar to the Basque political structure - the important role assigned to the Provincial Councils of Alava, Bizkaia and Gipuzkoa in fiscal policy with important roles in economic promotion and development. Furthermore, almost all public university activities are covered by a single entity: the University of the Basque Country, EHU, with a high degree of autonomy. This means that in the field of public governance, the clear leadership of the Basque government should also consider the need to coordinate research and innovation strategies with the Provincial Councils and the University of the Basque Country.

Key Policy Instruments

The key policy instruments in the field of research and innovation in the Basque Country are, first of all, the regional strategic planning tools, with a long experience in this region. Alongside sectoral strategic plans driven both by private sector clusters and the public, other key policy tools should be underlined: *i)* Strategies of technology centres; *ii)* University strategies (University Plan 2011-2014)*; iii)* Cross-cutting strategies; and *iv)* General strategies, mainly the Business Competitiveness Plan 2010-2013,the 2015 Science, Technology and Innovation Plan, approved in December 2011 by the Basque government.

Alongside the strategic analysis, the key policy instruments, from a financial point of view, are: *i)* funding programs for business RDI, provided by the Basque government the Provincial Councils, and the SPRI (Society for Industrial Promotion and Restructuring); *ii)* public funding of the technology centres; *iii)* Public funding of R&D provided by the University of the Basque Country; and *iv)* public funding of sectoral clusters. The tax policy related to business expenditures in RDI in the Provinces of Alava, Bizkaia and Gipuzkoa stands also for a relevant instrument.

Although the Basque government has a high capacity to influence the management of the education sector (basic public education, public colleges and universities), there is a limited capacity in the regulation of research activity, as a result of the regulatory power remaining in the Spanish state and of the high level of autonomy of the University of the Basque Country. From the point of view of management, these aspects have an impact on research and innovation of the technology centres. These canters underwent an important development in the Basque country and have played a key role in promoting applied research. Basque government and Provincial Councils have an essential role in the financing of technology centres, both in terms of its implementation, strategic investments, as in their regular funding.

Coordination activities

The co-ordination of activities of the Basque Science, Technology and Innovation System takes place at different levels. First, there is a significant level of consensus in strategic planning activities between the various public and private entities. The Basque Council for Science, Technology and Innovation, was created in 2007 to become the highest coordination body in science and technology policies between the Basque public bodies, including universities. On the other hand, different entities and agencies of the Science, Technology and Innovation Basque are structurally configured to perform relevant functions for the purposes of coordination between different elements of the system. Among them, the following can be highlighted: *i)* Technology centres, for the purpose of coordination between businesses and applied research, and the latter with public bodies; *ii)* The University of the Basque Country, for coordination between scientific activities and Government; *iii)* Mondragon University, for the purposes of coordination between businesses and university activities; and *iv)* The vocational training centres for the purpose interaction between business and technology development.

Measuring the effects and impacts

The financial goal established by the Basque government aimed to reach 3.00% GDP in R&D investment by 2015, starting from 2.02% in 2011. In terms of measuring outcomes and impacts of research and innovation policies, the current Plan for Science, Technology and Innovation (PCTI) 2015 uses a differentiation methodology between: *i)* Country Indicators; *ii)* PCTI 2015's own performance indicators; and *iii)* Indicators of investment in RDI. Country Indicators measure those aspects of the evolution of the Autonomous Community able to synthesize the level of its socio-economic development. The selected indicators are: *i)* GVA per worker; *ii)* Employment rate; and *iii)* Happiness and Health.

The PCTI has selected 25 Performance Indicators based on its own strategic objectives of the PCTI. The 25 indicators are grouped into the following nine strategic targets: *i)* shifting the business structure towards high value-added sectors, based on science, technology and innovation; *ii)* competitive and innovative companies at the forefront of global markets; *iii)* articulation of higher quality, excellence and efficiency public services, based on innovation; *iv)* social innovation as a cooperative strategy to comprehensively address the major global challenges; *v)* a science and technology System that adds value to the productive sector and is recognized internationally; *vi)* making the Basque Country as an advanced talent centre; *vii)* Basque Country and its diverse territory; *viii)* encouraging the country and citizens to embrace science, technology and innovation; and *xix)* a new funding model.

Finally, the performance indicators remain an essential goal of the PCTi 2015 Plan. They are divided in three areas of education, R&D and innovation: *i) Education (*Higher Education Expenditure to GDP (%); *ii) R&D* (R & D expenditure to GDP (%); Private expenditure on R&D as a share of GDP; Public expenditure on R&D as a share of GDP; Expenditure on R&D performed by businesses as a share of GDP; share of private funding from abroad; Expenditure on R&D performed by universities as a share of GDP; number of people employed in R&D; share of researchers per working Population and *iii) Innovation*, Innovation expenditure as a share of GDP.

Future Development for Smart Specialisation

The specialisation and prioritisation strategies have taken a decisive step in the Basque Country in with the Science, Technology and Innovation (PCTI) 2015 Plan adopted in December 2011. Recognizing the progress made by research and innovation policies of the Autonomous Region in previous decades, the Plan itself states that "One of the distinguishing features of this PCTI 2015 is the targeting effort of the science, technology and innovation system in areas of economic and strategic importance for the country". This prioritization is primarily focused on sectoral policies, previously directed primarily towards innovation through diversification. It was understood that the Basque Country (*Euskadi*) was too positioned in mature markets and that one of the vital means of promoting innovation and economic development was the creation of enterprises in sectors considered as key future areas in new technologies, energy, life sciences and nanosciences. This initial approach to sectoral innovation policies in the Basque Country has been gradually but substantially changed over the last decade.

As a starting point of strategic analysis, based on the criteria underlined in the Plan, the following basic Targeting Markets are selected, in terms of global macro trends: *i)* Aging *ii)* Energy; *iii)* Transport and Mobility; *iv)* Digital World; *v)* Science industry. To complement this, the Plan has also selected three areas in which the Basque Country is considered to have significant transverse capabilities*: i)* Biosciences; *ii)* Nanosciences; and *iii)* Advanced Manufacturing. On these eight areas, the specific objectives are established, top 5 sectoral and the last 3 crosscutting ones. The concept of crosscutting technologies has been acquiring a growing interest and importance in the Basque research and innovation policy, and now acquires a clear legitimization and institutionalization.

The strategic architecture of the PCTi 2015 is based on a careful diagnosis of the capabilities of the Basque System of Science, Technology and Innovation, diagnosis which ends with the corresponding SWOT analysis. The Plan presents nine strategic goals primarily based on the strengths of the system (and detailed above). The PCTi 2015 also defines the criteria for the implementation of a multilevel governance model, taking into account the specific characteristics of the Basque case, through a model designed in three levels: *i)* Leadership and Strategic focus; *ii)* Planning and management; and *iii)* Monitoring and evaluation; the purpose is to advance to a clear shared leadership, through management by processes and in the context of a systematic monitoring and evaluation.

The Basque special institutional setting calls for a shared leadership, in which the main institutions of the country are able to agree on the fundamentals of research and innovation policies: mainly the Basque government and the Provincial Councils. Hence, the central role attributed to the Basque Council for Science, Technology and Innovation in this process. The concept of shared leadership means significant challenges if to be managed efficiently, but trying to make use of a different leadership model is not realistic in the Basque institutional context. Finally, among the basic internal bottlenecks of the Basque innovation system, the following should be highlighted: *i)* Small size of the Basque companies; *ii)* Low percentage of GDP spent on basic and basic-focused research; *iii)* Lack of efficiency of the scientific and academic innovation; *iv)* Insufficient opening up of the innovation system; and *v)* Insufficient awareness of the public with science, technology and innovation.

Additionally, external threats detected in the Basque Country’s innovation system with a significance for the future are likely to include: *i)* Risk of loss of international market position of some Basque sectors; *ii)* Risk of non-differentiation in the new scientific and technological niches; and *iii)* Risk that the continuity of the economic crisis may pose to the economic sustainability of the Basque Innovation System.

Lessons learned and conclusions for political action

During the last decade the government of the Basque Country (*Euskadi*) has learned the importance of prioritisation and specialisation in sectoral innovation policies. Commitments for new sectors should be much targeted to very specific niches that, if possible, could then gradually expand. In addition, opting for boosting technologies widely used in the region is an interesting way of development and diversification. The Basque Country faces a fundamental challenge to substantially increase its investment in innovation and, particularly, its investment in focused basic research. It is imperative that every effort under public budgets is leveraged by structural reforms in the areas of education and research, including universities and research centres, allowing a better use of public resources. This probably requires a redefinition of public funding policies for research and innovation activities.

LESSONS LEARNED FROM THE OECD-TIP CASE STUDIES

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This chapter presents the synthesis of the 17 case studies on smart specialisation strategies in 12 countries that have been carried out by the OECD's Working Party on Innovation and Technology Policy (TIP). The case studies conducted by the national and regional teams that participated in this smart specialisation activity either have a horizontal character describing the government actions in a territory (region and countries) to develop smart specialisation strategies or a vertical character, describing these actions from the perspective of a particular domain or sector. The context of these cases differ considerably ranging from regions/nations with the challenge to mobilise entrepreneurial discovery processes in an economy that lacks high levels of innovative assets to regions/nations with the challenge to shift the focus of existing assets towards a new direction. All cases have in common that they reflect a need for economic restructuring in their territory and in their specific domains. As a result, the major differences exist in terms of: *i)* their ability to design/implement smart specialisation; *ii)* the tools used to shape the process; *iii)* the progress that has already been made in diversifying their knowledge base on the basis of a selected number of strategic domains; and *iv)* the adaptability of the regional/national system of governance to the new strategic paradigm.

New governance challenges for smart specialisation

The cases demonstrate a rich variety of multi-level governance in action. Each case is very context specific and involves many institutions, agencies and government bodies. The regional – national alignment of strategies and policies is key, although the focus of strategy formulation is mostly on the regional level. The national case of photonics in Korea demonstrates that what was once a national top-down strategy is now revealing structural bottlenecks as local stakeholders seek new technological opportunities. The new strategy for a regional photonics cluster in the region of Gwangju is more geared to the smart specialisation concept coordinating a network of local stakeholders.

In regions with relatively strong innovation capabilities, a rich network of institutions and well-organised stakeholders, one of the key challenges for policy makers is how to make a balanced choice of 'smart' priorities, taking account of existing (economic) strengths, as well as being flexible and open to new opportunities. In a considerable number of case studies public investments for R&D are still spread across a wide number of priority areas. In less advanced regions the key challenge is to provide the right framework conditions to build capabilities that stimulate the entrepreneurial discovery process, as well as mobilising stakeholders to interact with government and cooperate with each other. These are often more generic policies rather than domain specific policies.

The translation from strategy formulation to policy implementation appears to be difficult to codify and describe in the case studies. There seems to be a strong element of path dependency regarding the available policy instruments and rarely do governments start from scratch and adapt the available set of policies to the new strategy. Many of the case studies commented on the problems associated with policy proliferation and duplication and ultimately fragmentation. Several case studies document attempts by regional or industry authorities to try to streamline the policy architecture to allow a simpler and more coordinated policy approach. The rationale for this is that in each case policy simplification also helps to foster good prioritisation processes. Another issue highlighted by the cases is that policy priorities are often set in very broad terms (e.g. green energy) needing further stakeholder involvement to define this more precisely in terms of promising niches or value chains.

There seem to be no specific smart specialisation policy instruments. The cases illustrate how regions and countries use the ‘traditional’ set of innovation policy instruments and adjust their policy mixes to cater for specific domains, challenges and opportunities. What is specific for smart specialisation is an emphasis on entrepreneurship policies, on cluster support, including the facilitation of bottom-up strategy processes, within the broader policy mix. Demand led policies for smart specialisation are not widely used in our set of case studies. In the case of the low carbon automotive sector in the United Kingdom, the government played an important role as catalyst by introducing regulation that forced the industry to tackle its CO2 emissions.

A critical but also difficult element of smart specialisation and prioritisation is the de-selection or the abandonment of support to certain activities. This raises discontent with groups of stakeholders who have expectations of receiving support from their government. In Lower Austria two cluster initiatives, which initially enjoyed public support, were discontinued due to the weak support received by companies active in their sectors. The case studies demonstrate that clear cut criteria to select or de-select particular domains or activities are difficult to define and to make transparent. In addition some cases illustrate that different government actors in one country or region engage in multiple strategic processes without coordination, thus leaving room for a wide interpretation of policy prioritisation.

Stimulating entrepreneurial discovery processes

There has been real progress in the cases in terms of an empowerment and support of entrepreneurial actors to develop and implement novel ideas. Alongside wide stakeholder consultations, there are ample examples of policy makers that have actively embraced the triple helix process to stimulate bottom-up innovation and diversification. In most of the OECD cases the time of purely top-down strategy processes developed from the desks of officials seems long past. The depth and effectiveness of this stakeholder involvement are more difficult to assess across all cases.

The case studies clearly illustrate that the entrepreneurial actors are not only the single entrepreneurs that create new businesses. While the initial mobilisation for potential ‘new paths’ often comes from a small number of entrepreneurial people - lead actors from business, academia, research organisations, network associations - it needs the organisational power and strong commitment of various actors to translate ‘a good idea’ into a diversification strategy that impacts a whole cluster or domain. If structural change is the aim of the smart specialisation strategies, the potential for scaling up of individual ‘discoveries’ needs to be assessed and facilitated. Many cases illustrate this is a long term process that can take decades. In Flanders policy makers have developed ‘light structures’ for emerging clusters to develop common strategy processes and access earmarked project funding, assuming that light structures can be more easily dismantled if they do not show entrepreneurial dynamics.

Diversification from existing productive and innovative assets

The case studies show a variety of existing assets on which diversification and future economic growth will likely be based. Whether a state or region focuses on modernisation of existing industries or on building up of an emerging growth market, the potential for the exploitation of innovations by entrepreneurs and businesses is essential. Thus all governments in our cases are assessing the presence of critical mass of innovative companies in a particular supply chain or domain. Alternatively, in newly emerging field, a strong entrepreneurial culture for potential new companies in order to start up and grow is essential. Other obvious assets are the research and technology competences in companies, universities and research organisations. The case studies provide examples of additional types of assets in the regions. For the Andalusian Aerospace cluster for instance, the availability of skilled aerospace engineers is a key asset, just as the availability of world-class research infrastructures is for the Flemish Nanotech-for-Health domain. On the contrary, for the Lahti region the lack of skilled workers and research infrastructures is a main bottleneck for its smart specialisation strategy. An asset that should not be underestimated is the social capital available in the regions. The self-organisation of clusters and other "loose networks", the willingness to cooperate and to develop joint discovery processes and the ease of interaction between governments and stakeholders has shown to be very important in the dynamic cases.

Diagnostic tools to support smart specialisation

The analyses of the case studies show that most countries and regions use different methodologies such as science and technology indicators analyses, regional sectoral employment distribution, export indicators, road mapping, SWOT analyses and foresight approaches. The purpose of using different tools to gather evidence varies from making the snapshot of the region or country as *diagnostic tools* to assess its current strengths. A good example is the set of baseline and relative indicators for scientific, technological and economic specialisation developed by ECOOM (see Chapter 2) developed in the course if this OECD activity. This type of tools is mostly based on data from the past and present. The analysis can be used by policy makers as the evidence base to support certain domains or clusters. While the participating policy makers were provided with this data-set for the OECD exercise, it is too early to comment on how it is used by them.

We also have cases, such as the Nanotech-for-health case in Flanders, where the lead actors have developed a custom made tool to assess both the present strengths in research and technology, as well as the future potential impact of specific technological and medical competences on improving health. Combined with the analysis of emerging markets in this domain, this has served as a *prognostic tool* to direct the specialisation efforts towards specific disease patterns, technologies and emerging niche markets. The case also illustrates that in addition of having the technical decision support tool, the mobilisation of new stakeholders by disseminating the use of these tools, is as important to create broader support for a joint discovery process. This type of activities is very similar to technology road-mapping exercises that various governments have supported to underpin the strategic planning processes of sectors, domains and clusters. A potential role for governments could be to make the vast amount of strategic intelligence available at public sector organisations and in the private sector (e.g. commercial market studies) more easily accessible for stakeholders developing their joint strategies.

Open regions and cross-border activities

The need to develop linkages with regions and nations across the borders is evident for most cases. Internationalisation of individual businesses and clusters is high on the policy agenda. However the cases also demonstrate that implementing this in practice still faces quite some hurdles. For a start, the smart specialisation strategy processes are mostly defined within the parameters of the own region, even if this region borders another region with a rich pool of complementary assets, such as is the case with Lower Austria and its neighbouring region the city of Vienna. The Berlin/Brandenburg case is an exception (see Box). Despite the strong willingness to develop cross-border linkages with innovative eco-systems or clusters, the lack of practical policy instruments to support them creates a bottleneck. In the Malopolska region the life sciences cluster has established a co-operation agreement with the French Genopol Evry to jointly manage development projects, finance and to commercialize research.

Evaluation and monitoring

While good progress has been made to collect data and develop indicators to monitor the innovation performance of regions and countries, there is still a challenge to develop appropriate evaluation frameworks for smart specialisation strategies and policies. Most evaluation efforts are geared to the programme and project level. The impacts of these policies are mostly long term and are difficult to attribute to the overall strategy process. The case studies confirmed that policy makers are developing concepts and ideas how to evaluate smart specialisation strategies, but this task is still in progress. Particularly for the European regions, to prepare their smart specialisation strategies I order to obtain European Structural Funds, this is a task for the near future. For example, in Lower Austria a Steering Committee has been recently created to oversee the overall development of the strategy; it is principally responsible for information exchange and consensus building. On the top of that, the smart specialisation approach is characterized by sophisticated systems of evaluation, spanning from the impact of single initiatives on specific players to those of integrated initiatives comprising wider sectors of the economy/RIS. Precisely, measuring of impact then takes place at regional level, programme level and project level; the results of these evaluations are used to indicate future strategy.

Policy lessons from the case studies

The case studies confirm the main messages of the OECD Synthesis Report on Innovation Driven Growth in Regions:

- An impressive array of evidence based innovation strategy processes and policies have been put in place in our case study of countries and regions.

- There is a widespread understanding amongst policy makers of the bottlenecks and risks of top-down government induced specialisation.

- Stakeholder involvement and the combination of bottom-up and top down prioritisation processes appear to be a common pattern in studied regions. Nevertheless, assessing their effectiveness in the short and long term would need a closer study.

- The prioritisation process and focusing on a limited number of “knowledge investments” is not uncontested and still proves difficult to implement in policy practice. A lack of a coherent set of selection criteria, duplication of prioritisation processes and political pressures form hurdles that were reported in the studies.

- The key policy instruments for smart specialisation are already in place in today’s portfolio of innovation policies. The challenge is to find the appropriate policy mix that fits with the specific strategy of a region and to align it with the policy instruments available at national and international level

- The entrepreneurial discovery process can come from many actors, and requires a level of self-organisation and commitment from these stakeholders in order to scale this up from an individual “good idea”, to a novel direction with a potential to impact value chains and clusters. This requires considerable time and resources. The challenge for policy makers is to know when and how to support and prioritise these and to develop a balanced portfolio of existing and fledgling initiatives.

- Many valuable diagnostic and prognostic tools are currently used by policy makers and entrepreneurial stakeholders and contribute to enhance evidence based policy making. There could be a role for governments to make the availability of these types of strategic intelligence more transparent and accessible.

- Cross-border collaboration, an essential element of the smart specialisation approach, is high on the policy agenda but still faces various practical bottlenecks. This asks for multi-level governance solutions.

- Evaluation and monitoring of the overall smart specialisation strategies is work in progress, albeit building blocks – e.g. programme evaluations, monitoring systems, scoreboards - are put in place in many of the cases. The current state of the art for baseline data profiling for policy prioritisation is much more developed than that for on-going monitoring. The set of indicators, monitoring and evaluation is an important area where more needs to be done over coming months and years.

PART III – DIAGNOSTICS TOOLS AND INDICATORS FOR SPECIALISATION

This contribution discusses the role and use of diagnostic tools for smart specialisation policy development. It highlights the difficulties in assessing the stability and sustainability of a specialisation, and advocates that the development of a smart specialisation policy should only take place when local entrepreneurial commitment and development have already achieved a certain level of stability and coherence. Policy makers should decide whether and how to support these entrepreneurial processes. This chapter points to the need of engaging all entrepreneurial actors including firms, but also universities and research centres in this evaluation process. It shows how diagnosing apparent strengths, weaknesses, fits and misfits in terms of scientific, technological, innovative and economic capabilities, will allow policy makers to ask the right questions when evaluating specific entrepreneurial processes. The chapter gives an overview of some well-established baseline indicators for the past and present specialisations of countries and regions in science, technology, and economic development. Furthermore, it presents a number of additional indicators that may be useful to obtain a more advanced, multi-facetted view on national or regional specialisations, including potential interregional and international collaborations

SPECIALISATION PROFILES AND DIAGNOSTIC TOOLS

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Introduction

In times of global value chains and ambitions to restore industry competitiveness in many countries, a New Industrial Policy framework (NIP) is an important cornerstone for economic transformation agendas. A NIP is about stimulating innovation, competition and investment in know-how; it is not only about creating new economic sectors, but also about facilitating the transformation and restructuring of existing sectors/enterprises via stimulating their participation in new, global value chains. It is not just about choosing or selecting certain projects in a pure top-down, a priori manner. Instead, it is about encouraging competitiveness by focusing on the major drivers and entrepreneurial processes that create, reinforce and rejuvenate industries in view of market evolution.

In this respect, it is important to focus on a number of specific economic domains in order to realize the potential for scale, scope and spill-overs in knowledge production and use, as these are important drivers of productivity in the domain of R&D and other innovation-related activities. The idea of focusing on a number of specific domains is not enough to define smart specialisation. Past cluster policies at the regional level have often accentuated strongly mimetic programs of local and national industrial development – resulting in fostering knowledge base standardization, wasteful duplication and dissipation of the potential agglomeration economies at system level – as a multiplicity of imitative local government authorities compete to attract the small finite pool of mobile capital, management and knowledge resources. The resulting duplication, unproductive uniformity and lack of imagination and vision in setting R&D and cluster priorities can be expected to produce poor results; with most regions remaining unattractive and unable to compete with other territories in order to attract high value resources and to retain their best ones. Why would companies locate their R&D activities in a region with more or less the same, subcritical and ineffective knowledge base as other similar regions? Smart specialisation, on the other hand, involves the entrepreneurial discovery of what makes a local knowledge base original and distinctive and, thereby, exhibits “efficiency properties” at the system level – *i.e.* for an integrated regional system as a whole, such as the EU.

Smart specialisation is not a planning doctrine that would require a region to specialize in a particular set of industries. It is an approach to policy that considers whether and how those activities already strong or showing promise for a region can further benefit from R&D and innovation. Thus, rather than suggesting that a hypothetical region with strengths in tourism and fisheries should intensify its specialisation in these industries, it is a means to assess whether and in which activities that region would benefit from and should specialize in R&D and innovation in the sector of tourism or fisheries. Smart specialisation involves building regional policy for related industry diversification, a process based on the existing capabilities and industry commons and animated by the development of R&D and innovation activities in some targeted domains that offer present or future strengths for the regional economy. This implies that the diagnostic tools underpinning a NIP should provide insights in the scientific, technological, innovative and economic strengths of the region or the country. This is why we need both basic and more sophisticated indicators to monitor and assess those strengths, as well as potential matches and mismatches across scientific, technological, innovative and economic activities both within regions and within global value chains.

Smart specialisation: a challenging and complex process to capture and to measure

Once embarked upon the implementation of a smart specialisation strategy, one confronts the challenge of discovering the right domains of future specialisation. It is essential to operationalize the process of assessing cluster potential to reduce risks in policy implementation and in the practice of smart specialisation. However, precise ex ante estimation of the future value of an R&D specialisation that would be required for a cost-benefit analysis is a nearly impossible task and one better left to investment markets. Discovering the right domains is by no means trivial: technology foresight exercises or critical technology surveys ordered by administrations often produce the same ranking of priorities, without any consideration of the context and specific conditions of the "client" for whom the exercise is carried out. Too many regions have selected the same technology mix – a little bit of ICT, a little bit of nano and a little bit of bio – showing a lack of imagination, creativity and strategic vision. The discovery process is thus an issue in its own right.

Since it is usually very difficult to assess the stability and sustainability of a specialisation at an early stage, the smart specialisation approach is positioned at a particular point in the development cycle, one at which a degree of local commitment and development have already occurred and achieved a certain level of stability and coherence. At that point in time, NIP should decide whether or not these entrepreneurial processes have a real potential to create new economic activities or to transform existing industries. This includes diagnosing correlations between R&D and innovation resources and activities on the one hand and the sector structure of the economy on the other hand. Diagnosing apparent strengths, weaknesses, fits and misfits will allow policy makers and funding agencies to ask the right questions when evaluating and deciding whether and how to support specific entrepreneurial processes. It will also enable them to identify and bring together, in an interactive and iterative process of entrepreneurial action and policy learning, the relevant actors from academia, research and industry for reinforcement and cross-fertilization.

It is also crucial to evaluate the potential of the EU or OECD system as a whole to nurture regional smart specialisation strategies: extra-regional resources mobility, intellectual diaspora as well as the relations between regions at the forefront of innovation in general purpose technologies (GPT) and regions which are developing applications of a GPT (as a smart specialisation strategy) are important potential sources of spill-overs that might compensate some deficits in capabilities at a regional level. This again needs to be measured and assessed.

To meet this ex-ante assessment challenge, a smart specialisation strategy needs to be both flexible with regard to taking into account the specificities of technologies, businesses in a region, and markets and also "rigid" in its capacity to filter out initiatives that do not have the cumulative and externality properties of smart specialisation and that are vulnerable to "rent seeking" behaviour. Flexibility will require policy makers to have a broad view of the notion of entrepreneurial discovery. The needed entrepreneurial knowledge or vision can be held by other organisations than firms, including universities or research centres. Rigidity will require strong methods of measurement and ex ante evaluation of potentials, based on a good specification of the granularity (degree of specialisation) and relatedness (degree of complementarity) of existing specialisations.

Finally, ex post evaluation is important to analyse the growth trajectories of regions in the light of smart specialisation in order to increase the tightness of the concept and to generate a solid base of evidence on correlations between successful (and unsuccessful) smart specialisation strategies and growth performance at regional level. The development of a smart specialisation strategy and policy is hence an iterative process, requiring analysis, experimentation and learning, supporting interaction and fine-tuning amongst relevant actors and lead institutions.

Observing and measuring smart specialisation

Data and indicators about smart specialisation are necessary to make those processes and their impact more visible and robust, keeping in mind the purpose of building evidence and enacting policy. Without metrics, indicators and regular data collections, smart specialisation strategic opportunities will not be discernible and policy makers will be unable to track progress, assess structural transformations and compare strategies, while academics will not be interested in developing further empirical research that could improve the evidence base for such policies. There is, therefore, a need to build and maintain a collection of available statistics on several dimensions of smart specialisation. The strength of such an approach is that, depending on the quality of the indicators, it allows a genuine grasp of the phenomenon of smart specialisation under consideration. What distinguishes the smart specialisation strategy previous foresight or horizon-scanning efforts is a multivalent approach which takes account of “activity measures” such as research and development commitments, complementary investments in related industries and early stage market transactions in addition to more traditional indicators such as patenting and publication levels.

An important challenge in the area of smart specialisation is to enlarge the scope of empirical material that the economics profession will regard as legitimate, and perhaps even routine, in applied research. This effort is necessary if the economics of smart specialisation is not to remain purely abstract, but is able to link theory to practices. In the remainder of this section, we will give an overview of some well-established baseline indicators for the past and present specialisations of countries and regions in science, technology, and economic development. In addition, we present a number of additional indicators that may be useful to obtain a more advanced, multi-facetted view on national or regional specialisations.

Baseline indicator computations and their results are available for all countries and regions listed in Table 1 and are reported extensively in Appendix 1of this report.

Table 3.1. Countries and regions studies and analysed for the OECD 3S Project using baseline indicators

Countries	Regions
Australia	
Austria	Lower Austria (AT12) Upper Austria (AT31)
Belgium	Flanders (BE2)
Finland	Etela-Suomi (FI18)
Germany	Berlin (DE3) Brandenburg (DE4)
Netherlands	South Netherlands (NL4)
Poland	Malopolska (PL21)
South Korea	Jeolla (KR04)
Spain	Pais Vasco (ES21) Andalusia (ES61) Murcia (ES62)
Turkey	East Marmara (TR4)
United Kingdom	West Midlands (UKG)

Source: OECD

It is important to note that these indicators should not and cannot be used by policy makers to select priorities “only” in a top-down manner. Instead, they are to be used as a supportive tool to interactively identify, understand and assess already on-going entrepreneurial processes. The provide policy makers and lead actors with the right background information to engage in discussions with actors from academia, research and industry when evaluating whether and how to support specific smart and future-oriented entrepreneurial processes.

Scientific and Technological Specialisation Profile
Estonia

Scientific specialisations

Estonia's scientific activities are mainly situated in *Agriculture & Environment* and in *Biology* (see Table 3.2). Unfortunately, the absolute publication numbers are too low to give any valid assessment on the level of subdomains.

Table 3.2. Estonia's scientific specialisation

	1998-2002	2003-2006	2007-2010
Agriculture	1.44	1.72	1.68
Biosciences	0.96	1.20	1.14
Chemistry	0.91	0.94	0.85
Engineering	1.06	0.91	0.92
Geo- & Space Science	2.85	2.47	2.58
Mathematics	0.82	0.70	0.70
General and Internal Medicine	0.56	0.66	0.54
Non-Internal Medicine Specialties	0.56	0.56	0.57
Neurosciences and Behaviour	0.99	1.05	1.08
Physics	1.37	1.06	1.06
Biomedical Research	0.90	0.82	0.73
Biology	1.59	1.78	1.86

Technological specialisations

It is impossible to use patent indicators to develop a technological profile of Estonia. Estonia has very low patent numbers overall, and this for EPO, USPTO as well as for PCT patents. Moreover, Estonia does not have any patents in approximately half of the Fraunhofer technology domains. Calculating relative specialisation indices would give the false impression that Estonia is specialized in the other half of the Fraunhofer categories, while in fact, it has close to zero patent activity in these domains.

Baseline indicators for scientific specialisations

Indicators

A basic indicator for scientific output is the number of publications of a certain country or region, covered in a specific bibliographic database. Since the coverage and the profiles of most bibliographic databases are subject to yearly modifications, the measurement of regional or national scientific output always needs to be considered in relationship to the development of the database as a whole. In order to obtain insights in a nation's or region's publication trends, and hence its science base, over time, one thus needs to look at the national or regional share in the world's total publication output, instead of just measuring the absolute publication numbers of a country or region.

Specialisation in science is traditionally studied using national or regional publication profiles. The favoured measures are the Activity Index (AI) and its derivatives (Frame, 1977; Schubert and Braun, 1986).

AIij= Relative specialisation in scientific field *i* for country or region *j* =
$(P_{ij}/\Sigma_i P_{ij}) / (\Sigma_j P_{ij}/\Sigma_{ij} P_{ij})$

- *with i = 1 ... N (N = the number of scientific fields in the study);*
- *with j = 1 ... M (M = the number of countries or regions in the study)*
- *with P_{ij} = the number of publications in scientific field i in country or region j*

This index represents the share of country or region *j* in the total number scientific publications in scientific field *i*, *vis-à-vis* the share of country or region *j* in the total number of scientific publications of all countries or regions over all fields. Due to its relative character, this indicator allows for studying trends over time and does not suffer from potential biases in the degree to which countries (or regions) publish their research, making international or interregional comparisons possible.

The value of the Activity Index varies from zero to infinity. A value of *AIij* smaller than one means that a country or region *j* has a relative disadvantage in scientific field *i*. Values larger than one point to a relative advantage and imply that a country or region is relatively more specialised in scientific field *i* than the average country or region in the benchmark group.

In order to asses not only the profile, but also the impact of a country's or region's scientific activities, other measures are available (Schubert et al., 1983). The Mean Observed Citation Rate (MOCR) represents the actual scientific impact of a country or region and is measured as the ratio of the number of citations in a certain period over the number of publications. The Mean Expected Citation Rate (MECR) gives a benchmark value for the MOCR on the basis of journal's impact factors. The expected number of citations for a specific publication is calculated as the average citation frequency of all publications that appeared in the same journal in the same year as the focal publication. For a group of publications (*e.g.* all publications of a country or region in a specific period of time), MECR is hence the ratio of all individual expected citation frequencies over the number of all publications under study. The Relative Citation Rate (RCR), which is calculated as the ratio of MOCR over MECR, indicates whether a country's or region's publications have received more or less citations that could be expected on the basis of the citation frequency of journals. The advantage of this indicator is that it corrects for the differences in citation behaviour across different scientific fields. Variants of these indicators, such as Citations per Paper (CPP), Mean Citation Rate of Journal Packet (JCSm) and CPP/JCSm have been developed as well (Moed et al., 1995).

A general warning is in place when it comes to interpreting the Activity Index, MECR, MOCR and RCR for countries or regions with low absolute numbers of publications. Regions with very few scientific publications may be relatively specialized in a specific scientific field. However, this does not necessarily mean they are strong performers in this field. Instead, it may mean that they are simply even less strong in other scientific domains. Therefore, one should always take into account also the absolute number of publications of a country or region in a scientific field before drawing any conclusions regarding critical mass.

Databases

One of the most accepted and widely used data sources for the analysis of scientific specialisations is the Science Citation Index Expanded (SCIE), which is part of the Web of Science database of Thomson Reuters. Whereas critiques can be formulated regarding coverage and data handling by Thomson Reuters, the multidisciplinarity of the database, its selectivity based on quantitative criteria, the completeness of the address information for all authors, the inclusion of all references and the electronic availability make it one of the most appropriate data sources for bibliometric analyses. In addition to SCIE, the Web of Science also contains the Social Science Citation Index (SSCI), the Arts and Humanities Citation index (A&HCI), and the ISI Proceedings which contain conference proceedings.

Another multidisciplinary bibliographic database is Scopus. Officially named SciVerse Scopus, it is owned by Elsevier and available online by subscription. Scopus covers a wider journal range but it is currently limited to more recent articles compared with Web of Science. However, Scopus and WOS complement each other as none of them is all-inclusive (Falagas et al., 2007; Burnham, 2006).

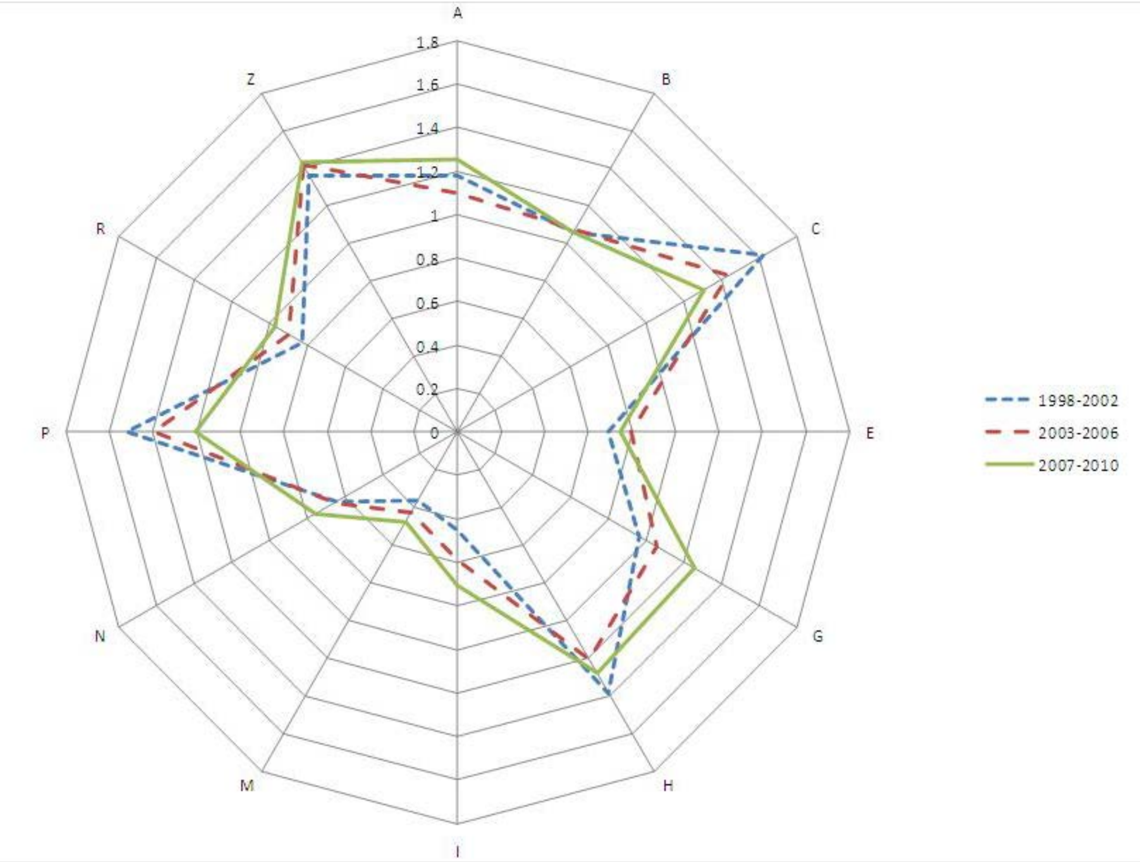
Whereas the Activity Index, MECR, MOCR and RCR were traditionally used to map the relative scientific specialisations of countries, regionalisation of publication data has made it possible to develop the same indicators on a regional basis. They then represent the scientific specialisations of a specific region vis-à-vis the specialisations of the world's scientific activities. As the SCIE data do not contain regional identifiers such as NUTS2 or NUTS3 codes, regionalisation of publication data currently requires text mining and programming procedures. Regionalization of the Scopus data is even more cumbersome given the lower quality of the address information in this database.

The successful application of the Activity Index and of RCR by scientific field strongly depends on the underlying subject classification system, and notably on its granularity. If a multi-level hierarchical scheme is used, one can look at specialisations on an aggregated level, and also zoom in on more detailed fields. One such hierarchical scheme is the Budapest–Leuven classification scheme (Glänzel and Schubert, 2003). It groups publications – based on the journal in which they appear – into 12 major fields, 60 sub-fields and 170 disciplines in the sciences. The disciplines are identical with the JCR Subject Categories of Thomson Reuters.

An example

Figure 1 below shows the Activity Indices for an anonymous country in the 12 major fields of the Budapest–Leuven classification scheme (Glänzel and Schubert, 2003). The data indicate that the country has a persistent relative specialisation in geosciences and space sciences (G), mathematics (H), and biology (Z). It also shows that the historical relative strengths of the country in chemistry (C) and physics (P) have become less pronounced in the past 12 years. This may be due to a decreased relative performance in chemistry and physics, but it could also be caused by an increased relative performance in all other science fields, which cause the relative specialisations in chemistry and physics to decrease. Further analysis of publication data for this country can shed more light on these dynamics.

Figure 3.1. Activity Indices in 12 major fields



Source: Thomson Reuters Web of Knowledge.

Baseline indicators for technological specialisations

Indicators

The most widely used indicators for technological activities make use of patent data. Despite several issues (see Box 3.1), patents are still a unique resource for the analysis of the process of technical change and innovation (Griliches, 1990). Patent indicators can be constructed at a macro- (country or region), meso- (industry sector) and micro-level (the single firm or institute). The level of aggregation differs according to the study objective.

Box 3. 1. Advantages and limitations of patent data as a proxy indicator for technological innovation

The advantages of patent data as a proxy indicator for technological innovation

- Patents cover virtually every field of technology useful for the analysis of the diffusion of key technologies (excepted software, which is generally protected by copyright and can be patented only when it is integrated in a technical process of product); Patents allow for geographical allocation and analysis;
- The detailed IPC-classification in patent documents allows for an almost unlimited choice of aggregation levels from broad fields to single technical specialty areas;
- Patent documents include many details of interest, such as dates of filing, grant date; technical classification; assignee and inventors, including their full addresses:
- The statistical processing of data is largely free of errors, because patent documents are legal documents in which the details are recorded carefully;
- Accessibility and electronic availability of patent data has greatly eased their use.

The limitations of patent data as a proxy indicator for technological innovation

- Firms differ in their propensities to patent (# patents per unit of expenditure on R&D or just # of patent applications);
- Technology fields differ in their propensity to patent;
- Countries differ in their propensity to patent: size, geographical position, institutional profile, national regulations… all give rise to different expectations of the returns from patent protection (combination with other input or output indicators is necessary);
- Differences among patent systems, arising from legal, geographical, economic and cultural factors (issue of 'home advantage') urge for caution when using patent indicators;
- Patents can differ considerably in their value, and measuring patent value is not always straightforward;
- Not all inventions are utilised and commercialised, and consequently do not lead to innovations;
- Not all innovations are patentable and those that are patentable are not necessarily patented.

Source : ECOOM

The simplest type of patent indicator simply is counting the number of patents that comply with one or more criteria (technology field, application year, inventor etc.). Comparing the number of patents between countries, industry sectors or companies in a certain technological field can provide a basic insight into differences in technological performance. In order to take into account differences with respect to size of the population and the economy, the size of its R&D and research community and the technological infrastructure, analysts relate patent counts to demographic (# inhabitants), economic and research variables (GDP, R&D expenditures). The resulting patent indicators are independent of the size characteristics of the countries and enable a more "equal based" comparison. This process is frequently referred to as a “normalisation process”.

An often developed but also often criticized indicator is the “propensity to patent”. This indicator contains the number of patents per dollar (or other monetary unit) invested in R&D or per R&D staff member. The propensity to patent indicates the extent to which R&D inputs (in terms of expenditures or personnel) are translated into patents, and can therefore be regarded as an (imperfect) measure of R&D output. Given that sometimes the levels of accuracy with which those input figures can be defined, measured and quantified are low, caution is warranted when interpreting propensity indicators.

When making international comparisons of patenting activity, one further has to take into account possible biases in the degree to which countries (or regions) patent their inventions. International comparisons of patents may be hampered by differences in national legal conditions surrounding the granting of a patent (institutional factors, domestic factors and the legal system). Relative indicators are used to avoid interpretational difficulties that are due to such differences and to compare countries on an "equal basis".

Relative specialisation indices integrate a comparison of profiles of a focal country/region to profiles of a group of reference countries regions. They can hence be used to answer questions like "Where does a country (or region) stand in various technology domains, compared to other countries (or regions)?" The "Revealed Technological Advantage (RTA)" is the most frequently used specialisation index:

RTAij= Relative specialisation in technology class i for country or region j =

$(P_{ij}/\Sigma_i P_{ij}) / (\Sigma_j P_{ij}/\Sigma_{ij} P_{ij})$

with i = 1 ... N (N = the number of technology classes in the study);

with j = 1 ... M (M = the number of countries or regions in the study)

with P_{ij} = the number of patents in technology class i in country or region j

This index represents the share of country or region *j* in the total number of patents in technology class *i*, vis-à-vis the share of country or region *j* in the total number of patents of all countries or regions over all technology classes. Due to its relative character, this indicator does not suffer from potential biases due to variations in domain-level or national/regional-level propensities to patent, making international or interregional comparisons adequate.

The value of the RTA-indicator varies from zero to infinity. A value of RTAij smaller than one means that a country or region *j* has a relative disadvantage in technology class *i*. Values larger than one point to a relative advantage and imply that a country or region is relatively more specialised in technology class *i* than the average country or region in the comparison group.

The distribution of the RTA-index for a country or region can be very skewed, with low values for many technology classes and extremely high values for some other technology classes. For graphical representations, the RTA is therefore often transformed to:

RTANij= (RTAij-1) / (RTAij+1)

The value of the RTAN-indicator varies from -1 to +1, with a positive value representing a relative advantage, and a negative value representing a relative disadvantage compared to the average country or region in the benchmark group.

Just as with publication data, one needs to be careful in interpreting low count data. Regions with very low patent numbers may be relatively specialized in a specific technology domain. However, this does not necessarily mean they are strong performers in this domain. Instead, it may simply mean that their performance in other technology domains is considerably weaker. Therefore, as a complement to RTA indicators, it is recommended to take into account the absolute number of patents of a country or regions a well before drawing any conclusions regarding critical mass.

Databases

For the calculation of the RTA and RTAN-indices, different patent databases representing different patent systems can and may be used. Besides national patent systems from individual countries, several supranational databases are available. In Europe, a European patent system has been established in parallel to these national systems. Data on these European patents are available from the European Patent Office (EPO). Data from the U.S. patent system is available from the United States Patent and Trademark Office (USPTO). One important way in which patent systems differ is in their publishing and granting procedures. In the USPTO system *e.g.*, until 2001, patents were only published after being granted. Grants do not follow a strict timetable and can in many cases take up to five years. In the EPO system, a patent is disclosed 18 months after priority application, regardless whether it has been granted or not. In the USPTO system, this disclosure policy has only since 2001 been adopted. Differences in patenting procedures mainly stem from a difference in patent approaches. In the USPTO system, patent protection is traditionally focused on the protection of the rights of the inventor; whereas the European system aims primarily at the timely diffusion of new technological information, in order to stimulate the rate of technological progress. An additional patent system operates under the Patent Cooperation Treaty (PCT). PCT is an international patent law treaty, which provides a unified procedure for filing patent applications to protect inventions in each of its contracting states. A PCT application does not itself result in the grant of a patent, since there is no such thing as an "international patent". The grant of a patent is a prerogative of each national or regional authority. In other words, a PCT application, which establishes a filing date in all contracting states, must be followed up with the step of entering into national or regional phases in order to proceed towards a grant. The PCT procedure essentially leads to a standard national or regional patent application, which may be granted or rejected according to applicable law, in each jurisdiction in which a patent is desired.

Twice per year, the European Patent Office publishes the PATSTAT database, covering large patent systems like EPO, USPTO, PCT, JPO, as well as about national patent systems data for about 100 countries worldwide. Access to the PATSTAT database is obtained through a license agreement with EPO.

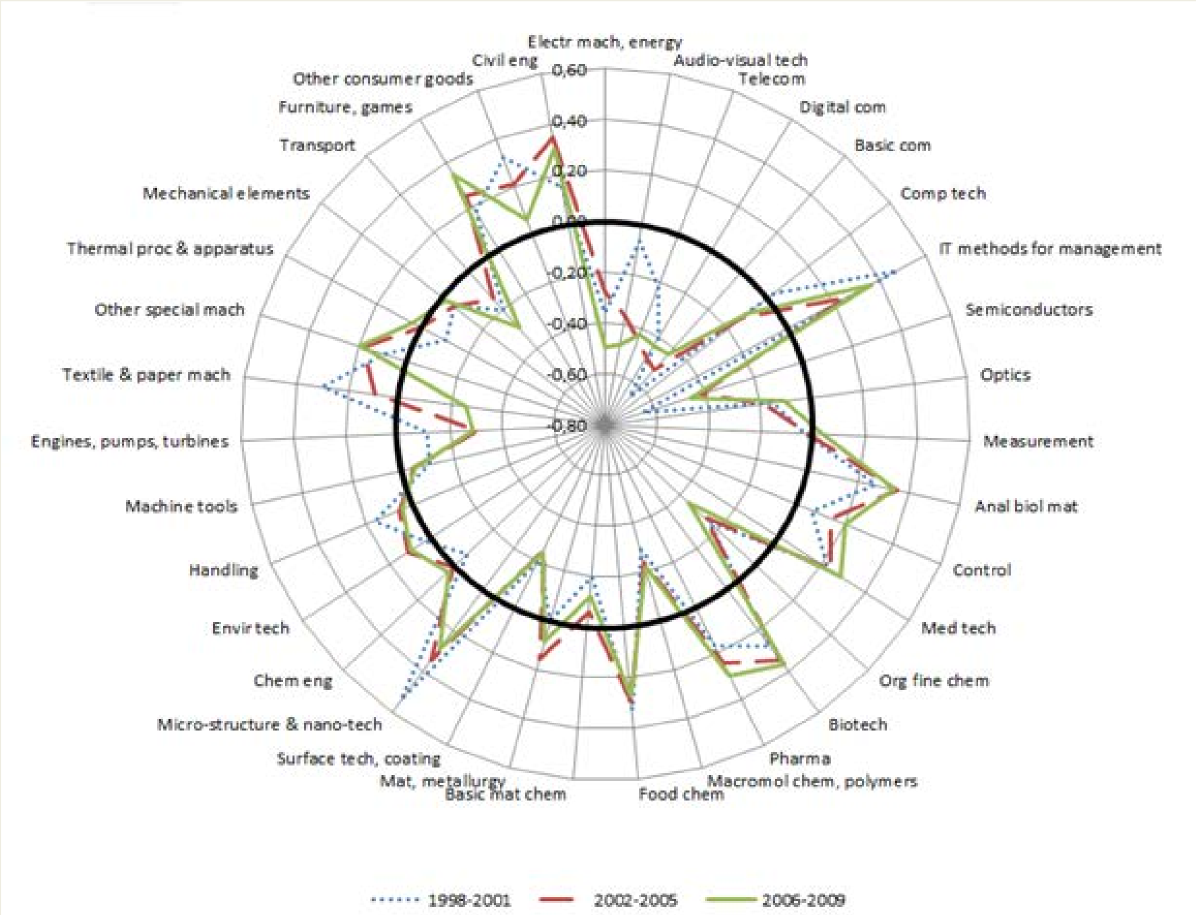
When calculating the relative specialisation of a country or region, a benchmark group of countries needs to be chosen. The choice of this benchmark group will often be determined by the patent data source used. When using USPTO, the whole of patents in the USPTO system can serve as benchmark. However, one can also chose to limit the benchmark group to a subset of countries or regions. For example, one can use EPO patent data to compare the specialisation profile of Sweden with that of all Scandinavian countries, or to compare the specialisation profile of Andalusia with that of Spain as a whole. It should be noted that the regionalization of patent data, based on inventor and applicant addresses, is not available in patent databases. However, ECOOM[38] and OECD[39] have invested substantial efforts to regionalize patents (NUTS2 and NUTS3 level), based on inventor and applicant addresses.

Within each patent system, International Patent Classification (IPC) codes are attributed to every patent. IPC is a hierarchical patent classification system to classify the content of patents in a uniform manner into different technology domains. Given the detailed subdivisions of the IPC classification scheme, researchers have developed more aggregated technology classification schemes. The Fraunhofer Gesellschaft, for example, has regrouped all IPC classes in 35 main technology domains (Schmoch, 2003). Based on its IPC-code, each EPO patent can be attributed to one of these 35 technology domains. These 35 domains can then be used for the calculation of RTA’s and RTANs.

An example

Figure 2 below shows the RTANs for an anonymous country in the 35 technology domains according to the Fraunhofer classification. The data show a relatively stable specialisation profile, with relative strengths in IT methods for Management, Biotech, and Micro-structure & Nanotechnology. There is a clear decrease of relative technological specialisation in Textile & Paper Machines.

Figure 3.2. RTANs for 35 Fraunhofer classes



Source: PATSTAT

Baseline indicators for economic specialisations

Indicators

An often-used indicator of a country's or of a region's economic specialisation, is the Revealed Comparative Advantage (RCA) indicator. This indicator is typically calculated with export data (Balassa, 1965), but other economic indicators such as employment, Gross Domestic Product (GDP), number of newly established firms, and degree of innovation can be used as well. The RCA-indicator is calculated as follows:

RCAij= Relative specialisation in economic sector *i* for country or region *j* =

$$\frac{\text{export by country or region j in economic sector i / export of country or region j in all economic sectors}}{\text{export all countries or regions in economic sector i / export of all countries or regions in all economic sectors}}$$

Due to its relative character, this indicator is not too much impacted by the occurrence of economic upturns or recessions, allows for international or interregional comparisons and for studying trends over time.

The distribution of the RCA-index for a country or region can be very skewed, with extremely high values for some economic sectors and low values for all other sectors. For graphical representations and for reasons of interpretation, the RCA can therefore be transformed to:

RCANij= (RCAij-1) / (RCAij+1)

The value of the RCAN-indicator varies from -1 to +1, with a positive value representing a relative economic advantage, and a negative value representing a relative economic disadvantage compared to the average country or region in the benchmark group.

Databases

The successful application of the RCA and RCAN indices by economic sector strongly depends on the underlying sector classification system, and notably on its granularity. Economic sectors are often classified using NACE or ISIC codes. However, international databases on sectoral economic activity often aggregate many NACE or SIC codes into broad overarching sectors, such as ‘manufacturing’. These highly aggregated classifications are too broad to generate insights in the specialisation profiles of countries or regions. In order to develop specialisation profiles, internationally comparable data is necessary on a relatively fine-grained classification level.

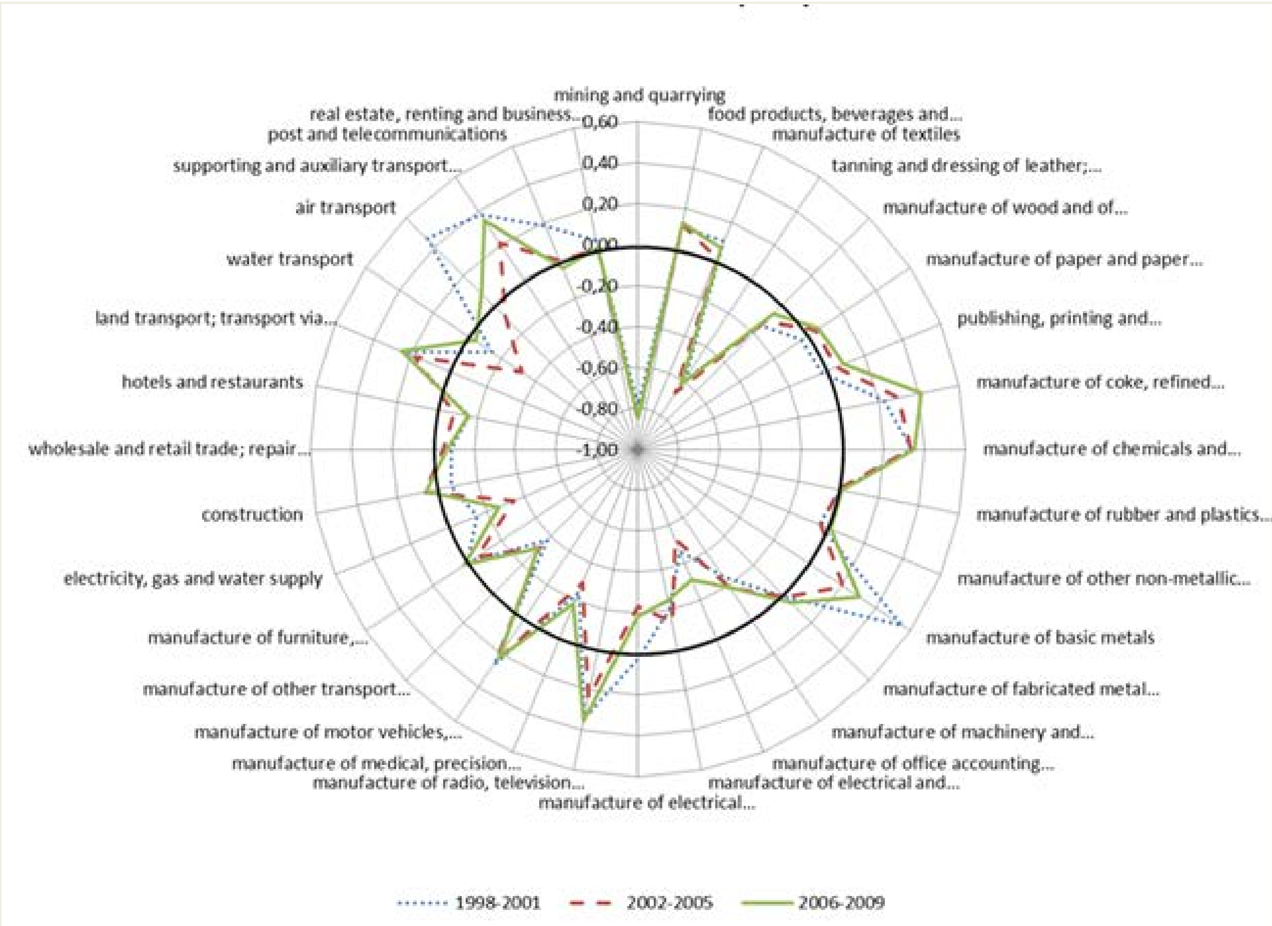
For countries, sufficiently detailed, internationally comparable economic data is available from OECD (www.oecd-ilibrary.org/industry). The OECD Statistics on Measuring Globalisation database, the OECD databases on Structural and Demographic Business Statistics and the OECD Structural Analysis Statistics database contain many different sector-specific indicators for economic activity, including international trade, R&D expenditures, birth and death rates, High-Growth enterprises rates, turnover, value-added, production, operating surplus, employment, labour costs and investment. Benchmark data can be obtained by summing up sectoral data over all countries in these OECD database (or over a smaller group of benchmark countries if desired). Also Eurostat publishes ample economic data on a sufficiently detailed sectoral level. The limitation of Eurostat data compared to OECD data is that the benchmarking group pertains to the whole (or a selection) of European countries, making worldwide comparisons impossible.

Unfortunately, on a regional level, it is difficult to find sufficiently detailed, internationally comparable economic data. The most appropriate data appear to be OECD’s regional labour market statistics (e.g. number of establishments or number of employees per TL2 region), which are available for a selection of countries and regions and are aggregated in 37 industries. Due to limited data availability for some sectors in multiple regions and countries, only 32 industries can be used in comparative analyses. A limitation of these data is that not all industries represented. In a case a region would like to use other indicators for its regional economic specialisation indicator, it can collect its own data and compare this to worldwide indicators (e.g. the sum of nationally available statistics over all OECD countries). However, in this case, special care needs to be taken regarding data collection methodology in order to obtain internationally comparable statistics. In Flanders for example, export data are calculated without quasi-transits, while OECD data include quasi-transits, making international benchmarking difficult.

An example

Figure 3 below shows the RCANs for an anonymous region in 32 industries according to OECD’s regional labour market statistics. The data show a relative specialisation in Manufacture of Coke and Refined Petroleum Products, Manufacture of Chemicals and Chemical Products, and Manufacture of Equipment for Radio, TV and Communication. We see that the relative employment in Air Transport and in the Manufacture of Basic Metals plummeted, but recovered somewhat.

Figure 3.3. RCANs in 32 economic sectors



Source: OECD regional labour market statistics

Combining baseline indicators for specialisations in science, innovation, and economic development

By comparing specialisation indicators over time, changes in scientific, technological or economic specialisations can be analysed. Interesting insights can also result from studying relations/ interdependencies between scientific, technological and economic specialisations. Examples are two-dimensional mappings of technological and economic specialisation indicators (RTA's and RCA's), or of scientific and economic specialisations (AIs and RCA's) that generate insights in future endeavours. For example, it is questionable whether a historically important economic specialisation can be expected to last if scientific and technological strengths in underlying areas are absent. Similarly, strong scientific or technological positions that do not translate into economic performance raise policy questions regarding knowledge transfer. For studying these issues, longitudinal analyses of patterns in scientific, technological and economic specialisation – and potential lags between the different components – could be highly relevant as well.

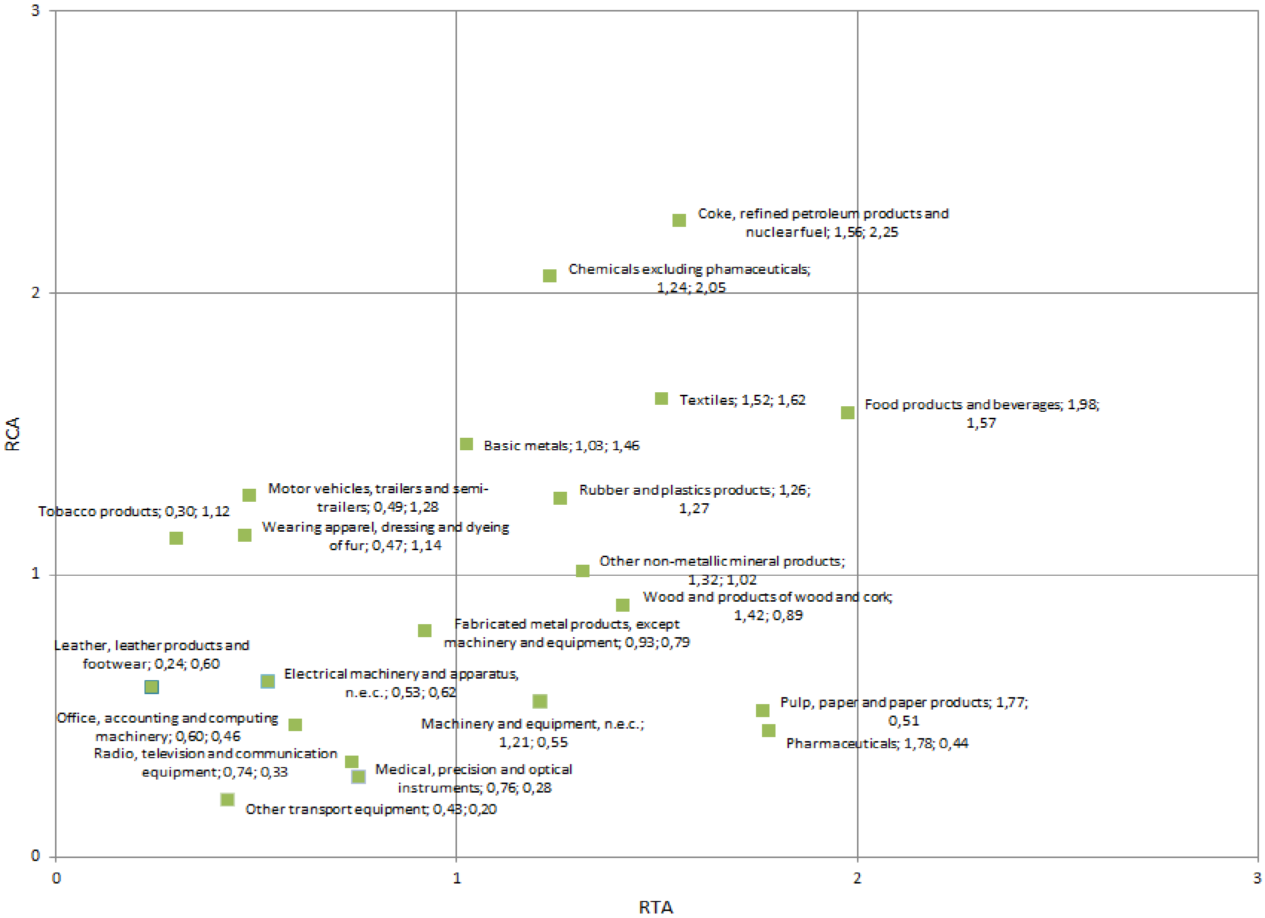
Some first insights can be gained from simply comparing Activity Indices per science field, RTANs per Fraunhofer technology class, and RCANs per economic sector. For example, if a country or region has a strong economic specialisation in Manufacturing of Chemicals, but is relatively under specialised in technology domains like Chemical Engineering, Basic Chemistry, Organic Fine Chemistry, and

Macromolecular Chemistry, one can raise the question whether and how the economic strength of this sector can be made sustainable.

Whereas the example of Chemistry is rather straightforward, for some scientific fields, technology domains and economic sectors, it is far less clear how they are related to each other. For example, if a country or region has a strong scientific specialisation in the scientific sub-field of Mycology, it may not immediately obvious to which technological areas or economic sectors this may contribute. In such cases, conversion schemes mapping the general interdependencies between scientific, technological and economic specialisations are useful. For example, using Schmoch (2003) and Schmoch (2008), a conversion scheme can be developed mapping the 35 Fraunhofer technology classes (grouping IPC classes) to 44 industrial sectors (grouping NACE industries). The result is a list of 667 4-digit IPC8 classes with on one side the matching Fraunhofer technology sectors and on the other side the corresponding NACE sectors (Callaert et al., 2011).[40] The conversion scheme provides an overview of which technological developments in general feed into which economic industries. By comparing the RTA's of a country or region with its RCA's for a specific technology-economy node, one can compare its technological and economic specialisations in this node.

Figure 4 below provides an example. We can see that for most domains, there is a match between the technological and the economic performance of this country. However, we also see that for the economically strong domains of Tobacco Products, Motor Vehicles, Trailers & Semi-trailers, and Wearing Apparel, Dressing and Dying of Fur, the technological activity is relatively weak (RCA > 1 and RTA < 1). This may raise doubts about the sustainability of these industries and may inspire policy makers to develop stimuli for technological advancements or international technological collaborations in these important economic sectors. On the contrary, we see that a strong relative technological position in Pharmacy and Pulp, Paper and Paper Products does not coincide with a strong economic performance (RCA<1 and RTA > 1). Policy makers may therefore want to support collaborations between technology developers and industry actors in these domains.

Figure 3.4. Comparison of technological and economic specialisations



Source: ECOOM

Additional, sophisticated indicators

Two limitations of the baseline indicators presented above, is that: *1)* they are mostly geared towards past and present specialisations (although some potential problems can be identified by comparing scientific, technological and economic specialisations as explained above); and *2)* they are limited to scientific, technological and economic specialisations. Additional indicators that can overcome some of these limitations will be presented below. Even more than the baseline indicators above, they are difficult to calculate on a regional level, and require technical skills in terms of calculation as well as careful interpretation.

Mapping interactions between science and technology

Besides simply comparing specialisations in science and technology, more advanced analyses of publication and patent data can point to opportunities in technology development. In particular, the use of information contained in patents can be used to construct "maps of technologies". For this purpose, besides information on the innovating company and the specific characteristics of the invention itself, information is gathered on the references contained in each patent application both to previous relevant patents and to research papers reporting results on which the invention is based. “Maps” of various technological (sub-)

domains can then be constructed by examining the interrelation between frequently cited patents. Co-citation, co-classification or co-word analyses are possible.

Moreover, within each (sub-)domain, an assessment can be made of the relative position of different actors ranging from companies, research institutes to entire countries or regions. In addition, the citations present in patents can also be used in attempts to map the science-technology nexus, which can point to interesting opportunities for technology development and to gaps in the regional or national scientific profile. For example, if a region or country is particularly strong in a specific science domain, analysis of the science-technology nexus will yield a number of technological domains that could benefit from this scientific knowledge. This could be a basis for stimulating interaction and collaboration between scientific and technological actors from these respective fields. On the other hand, if a region or country is strong in specific technologic developments, analysis of the science-technology nexus can point to relevant scientific knowledge and partners for future collaboration. Note however that this use of citations in patents to the scientific literature should be handled with the necessary care for validity and accuracy in both analysis and interpretation.

Detection of emerging scientific and technological fields

For monitoring the evolution of disciplines and research topics and for the detection of new, emerging topics within existing disciplines, sophisticated techniques are required. The reasons for this are the peculiarities that can be found in citation practices, the changing vocabulary over time and the use of natural language in these "local" structures. This means that bibliographic coupling and co-citation, on one hand, and term frequencies originated from text mining, on the other hand, are usually not sufficient at this level if applied alone. The idea of combining citation-link and text-based approaches therefore aims at pronouncing the individual advantages of the two components and, at the same time, at reducing the by-effects of the mentioned shortcomings. The combination of the two methods also makes it possible to cluster documents whenever citation links are weak or even missing (as, for instance, in the applied sciences, most fields of the social sciences and in the humanities) or the common language and vocabulary used in the documents result in textual similarities that have not sufficient discriminative power for meaningful classification. Hybrid text-citation links can be used to create links between clusters and topics of the different time periods and thus to identify emerging topics, which are expected to have already reached a certain critical mass, to form (more or less) coherent clusters, and to still have strong links to their "mother fields" from which they arose. Three particular cases are considered to indicate such new, emerging topics.

- Existing cluster with an exceptional growth with regard to the second period,
- Completely new cluster with its root in other clusters in the previous period and
- Existing cluster with a topic shift in the new time period.

The identified topics can then validated by experts and further analysed using bibliometric methods such as indicators of publication activity and citation impact and (international) collaboration of the main actors.

Similar approaches can be envisaged for the detection of promising new technological domains using patent data. These promising scientific and technological domains can and should then be discussed with economic actors in order to assess potential economic use and impact.

Mapping interregional and international collaboration

Publication and patent information can also be used to study patterns of collaboration within and between science and technology development, by looking at the phenomenon of multiple authors, inventors or applicants per patent. Both for EPO and USPTO patents, co-inventorship takes place in the majority of patents, while co-applicants only appear on a minority of patents. Data on co-applications need to be interpreted with caution. The location (and hence the region or country) of the application can differ from the location of the invention, especially in multinational companies that centralize their intellectual property management or that file their patents through subsidiaries located near patent offices (e.g. Den Hague for EPO patents). For the same reason, a co-application does not necessarily imply an actual collaboration between different organizations, regions or countries. Co-applications can involve different subsidiaries or business units of the same company, which can either indicate an actual collaboration or a strategic/practical decision of the organization to involve an additional unit or subsidiary in the application process. Analysing co-inventorship can provide a useful complementary mapping in this respect.

A relevant indicator for studying co-authorship or co-inventorship patterns between countries or regions is the so-called cosine measure according to Salton, or the Salton measure:

$$r = \frac{r_{ij}}{\sqrt{n_i \cdot n_j}}$$

- *with r_{ij} = the number of publications / patent applications with co-authors / co- inventors from country or region i and country or region j*
- *with n_i = the total number of publications / patent applications with authors / inventors from country or region i*
- *with n_j = the total number of publications / patent applications with authors / inventors from country or region j*

Due to its relative character, the Salton measure does not only allow for comparisons across countries or regions, but also across different time periods.

Mapping the broader picture

In addition to publications, patents and economic performance indicators, other data are relevant for assessing a country’s or a region’s potential. Some examples include expenditures on innovation and research and development in specific sectors, the availability of human capital for certain scientific, technological and economic areas, the presence of IT-infrastructure in specific sectors, etc.

On a national level, some sector specific datasets are available. For example, sectoral data from the European Innovation Survey and R&D Survey can be used to construct relative specialisation indices, indicating in which sectors countries spend relatively more on innovation and R&D than the chosen benchmark group. Unfortunately, it is very difficult to find reliable regional data on these topics. Most regional innovation and R&D data does not contain sector specific information needed for the construction of specialisation profiles.

For the mapping of human capital, educational data, such as the number of students enrolled in different educational programs could be of relevance. However, this data should be rather detailed in order to provide insights in potential future specialisations or strengths. For example, it does not seem enough to know the number of engineering students in a country or region without knowing their specific field of study.

Conclusion

Smart specialisation involves building regional policy for related industry diversification based on the existing capabilities and industry commons and animated by the development of R&D and innovation activities in some promising domains. Since is always very difficult at an early stage to assess the stability and sustainability of a specialisation, *the development of a smart specialisation policy should only take place when a degree of local entrepreneurial commitment and development have already occurred* and achieved a certain level of stability and coherence. At that point in time, policy makers should decide whether and how to support these entrepreneurial processes.

In order to assess whether these processes have a real potential to create new economic activities or to transform existing industries, *diagnosing apparent strengths, weaknesses, fits and misfits in terms scientific, technological, innovative and economic capabilities will allow policy makers and funding agencies to ask the right questions* when evaluating and deciding whether or not to support specific entrepreneurial processes. In this evaluation process, *all entrepreneurial actors including firms, but also universities and research centres should be engaged*. Engaging them will not only allow policy makers to develop a thorough insight in the matches and mismatches of their specialisations, it will also initiate and nurture the necessary collaborations among these different actors. If the evaluation exercise shows that some specific capabilities are missing, one should *look outside the borders of the region or country* and see whether interregional and international collaborations with stronger partners can be set up.

What distinguishes the smart specialisation strategy previous foresight or horizon-scanning efforts is a multivalent approach which takes account of “activity measures” such as research and development commitments, complementary investments in related industries and early stage market transactions in addition to more traditional indicators such as patenting and publication levels. An important challenge in the area of smart specialisation is to enlarge the scope of empirical material that the economics profession will regard as legitimate, and perhaps even routine, in applied research. Whereas some well-established baseline indicators for the past and present specialisations of countries in science, technology, and economic development have been developed, regional internationally comparable data – especially on economic specialisations – is underdeveloped. In addition, a number of indicators for innovation and research and development commitments, complementary investments in related industries and early stage market transactions, as well as for interregional and international collaborations deserve more attention in the future.

The baseline indicators described and developed in this chapter help identifying, designing, developing, building and assessing smart specialisations in countries or regions. They need to be further developed into more sophisticated measures that better capture the interactive nature of entrepreneurial processes that drive and underpin smart specialisation strategies. In addition, they should always be viewed as supportive and informative, rather than decisive and formative. They provide input and interpretation to the critical processes of entrepreneurial discovery and policy learning. They are valuable aids to assess smart specialisation strategies and trajectories. Though, they can never substitute for the interactive and iterative processes that ultimately support the design and growth of smart specialisation choices.

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SMART GOVERNANCE FOR SMART SPECIALISATION STRATEGIES

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Smart policies need smart governance. The governance question lies at the heart of the OECD-TIP project on smart specialisation: how should a smart specialisation strategy be designed and implemented? What is the role of policy and how to identify the limits and value-added of public action? Who should be involved and how? And, crucially, how to make sure that the strategies are reaching their intended goal of transforming economies towards more competitive, job-rich and sustainable ones? The proposed smart specialisation approach raises conceptual as well as concrete questions for policy-makers. However the process does not take place in a vacuum: most countries and many regions have experience in designing and implementing innovation policies on their territories. This creates a baseline on which the new challenges posed by the smart specialisation approach are turned into concrete choices. These choices concern primarily: *i)* at identification stage, the ways and means to set an entrepreneurial discovery process in motion in order to identify specialisation niches; *ii)* at the implementation stage, the instruments to be used by public authorities and the organization of the policy mix with a view to support the priorities; and *iii)* on a continuous mode, the organization of robust and outcome-oriented monitoring and evaluation mechanisms with the goal of raising policy effectiveness.

Introduction

An enquiry has been implemented under the OECD-TIP project to provide a state-of-the-art of the situation in OECD countries and regions with respect to the governance of smart specialisation. The results of the enquiry, discussed in this chapter, provide a snapshot on the current situation with respect to the design and implementation of smart specialisation strategies. The conclusion points to several governance challenges to be addressed, if the smart specialisation approach is to offer the expected transformative power on national and regional economies.

The OECD-TIP enquiry on smart specialisation governance

Goal of the governance enquiry within the TIP project

The goal of the governance enquiry within the OECD TIP project is to collect and analyse information on governance processes for defining and implementing smart specialisation strategies in a sample of (self) selected OECD countries and regions.

Method and scope

Because of the complexity of the issue, phone interviews have been chosen as the most appropriate method to enquire with key policy-makers in the countries and regions participating in the project. A questionnaire has been defined, communicated to TIP participants, and used for the phone interviews. The questionnaire is produced in two versions, national and regional. It intends to map key elements of governance mechanisms and policies for smart specialisation. In particular, the questionnaire investigates: *i)* the priority areas that are defined in policies (both explicitly and implicitly), *ii)* the process through which these priorities are identified, *iii)* the mechanisms and budgets used to support these priorities, and *iv)* the monitoring and evaluation mechanisms used to support the policies.

Finding one adequate respondent per country and region involved in the OECD-TIP project is not an easy task: this is due to the fact that innovation policy is still a “homeless” policy in many contexts (sitting in between the S&T and Economic Ministries), and the problem was compounded by the non-familiarity of policy-makers with the smart specialisation concept. In several cases, two persons took part in the interview; and preliminary internal discussions by the interviewees were needed to make sure that all questions could be covered during the phone interview. The interview phase was completed during the months of March and April 2012 and resulted in draft filled templates submitted for comments to the interviewees. The preliminary results of the interviews were presented and discussed at the OECD TIP workshop in May 2012 in Paris.

Coverage

The following countries and regions decided to take part to the enquiry.

Table 3.3. Participants in the governance enquiry

Countries	Regions
Australia	
Austria	Lower Austria Upper Austria
Belgium	Flanders
Czech Republic	South Moravia
Estonia	
Finland	Lahti
Germany	Berlin/Brandenburg
Netherlands	Noord Brabant
Poland	Malopolska
South Korea	Gwangju
Spain	Andalucia Basque country
United Kingdom	
Total: 10	**Total: 11**

A sample of 10 countries and 11 regions is probably large enough to provide a good snapshot on governance issues for the smart specialisation process (but not a complete overview of all policy approaches to the concept throughout the OECD).

The enquiry results: general observations

Different levels of familiarity with smart specialisation concept

The discussions during the interviews revealed an apparent split between two types of countries and regions:

- Countries and regions which have a rather clear understanding of the various ingredients of a smart specialisation strategy, and hence see the limits of their current policy-making: they tend to give responses enlightening the distance between their practice and the smart specialisation concept (e.g. Flanders);
- Countries and regions that are less advanced in innovation policy and have not yet developed a consensus around the smart specialisation concept: they tend to provide more optimistic responses, e.g. taking research specialisation as an indicator of smart specialisation (e.g. Poland).

Subjectivity of assessments

Many questions are of an interpretative nature and the assessment scales used by the various respondents differ, making inter-country/regions comparisons hazardous. Countries/regions that are less experienced in the development of strategic approaches for innovation policy tend to use a less demanding rating scale, e.g. the influence of studies on selection processes will be rated higher in a country/region where the use of studies is a more recent feature of the policy-making process. Similarly the degree of influence of various types of stakeholders in the selection process is highly context-dependent, hence assessment scales on the strength of these influences differ quite a lot across regions and countries in the sample. There is no standardized metrics for such assessments that could be used to harmonise the answers.

Explicit versus implicit prioritization

The questionnaire is built upon a rational logic for policy-making, whereby: decisions are taken about the priorities, which are then translated into prioritized instruments and budgets. Even when the selection of priority topics is done on a bottom-up basis, there is an expectation that policy-makers would then endorse the priorities and make them explicit. However in many cases such a rational process is not present: priorities are unstable or fuzzy, or there is a wish not to make them explicit even if they are integrated into the policy mix (e.g. Lower Austria strategy announces functional priorities such as internationalization, new firm creation etc. but no sectoral ones, while at the same time has a quite concentrated public investment process on a few selected fields, organized through the public funding of clusters and technopoles).

High degree of similarity and breadth in priorities across the sample

When priorities are explicit, it is striking to see how similar and broad they are. Most regions and countries pick up their priorities from the following menu, and only few of them have defined more specific specialisation niches under these broad areas: *i)* ICT; *ii)* Life science, biotechnology, health; iii) Materials and nanotechnology; *iv)* Logistics, transport, mobility; *v)* Energy/green energy; and *vi)* Green technologies/Clean technologies.

Important gap between stated priorities and the policy mix

In most cases respondents were unable to provide a strategic view of the policy mix and public budgets, dedicated to the priorities. The way through which policy instruments serve the priorities and the split of budgetary allocations to the prioritized areas could not be elucidated through the enquiry. Accordingly, monitoring and evaluation systems, when in place, are not (yet) geared towards the follow-up and assessment of the prioritization of policy.

The enquiry results: detailed analysis

Definition of priority areas for R&I and economic development

The assessment of whether there is, or not, a prioritization process at work in regions and countries, is a major challenge for this enquiry. The questionnaire states that the existence of explicit priorities is to be assessed on the basis of three criteria: *i)* policy documents stating such priorities; *ii)* dedicated budgetary allocations to these priorities; and *iii)* existence of major institutes, organizations or programmes dedicated to these priorities. Priorities are considered as implicit if some domains receive '*de facto*' more policy support than others, while policy statements, funding channels, programmes and organisations remain generic. The enquiry reveals:

- a frequent dissociation between the three above elements: priorities are stated in policy documents but not translated into policy instruments; de facto prioritization is not declared in policy documents; or there is inconsistency between expressed priorities and actual use of targeted instruments;
- a timing issue: priorities may be expressed today but instruments are a legacy of the past and it takes time to reshuffle them into the new priorities.

As a result, the list of “priority areas” for a country/region tends to be unstable across the various parts of the questionnaire.

Both countries and regions tend to declare the existence of explicit priorities, more frequently for research and innovation than for economic development. Prioritization is more intense at regional than at national level

Despite these methodological difficulties, Table 1 indicates that the vast majority of countries and regions in the sample declare having set explicit priorities, more intensively for research and innovation than for economic domains.[41] Only one region, Lower Austria,[42] does not set research and innovation priorities explicitly; while six countries and three regions do not report explicit economic priorities.

Prioritization is in general more frequent at regional level than at national level (Table 3.2), all regions state that policies in the economic domain are either explicitly or implicitly prioritized, while four countries declare no prioritization in economic domains.

Table 3.4. Presence of RDTI and Economic priorities

	Research and innovation	Economic development
Countries		
Australia	Explicit	Implicit
Austria	Explicit	No
Czech Republic	Explicit	Implicit
Estonia	Explicit	No
Finland	Explicit	Explicit
Netherlands	Explicit	Explicit
Poland	Explicit	Explicit
South Korea	Explicit	Explicit
Spain	Explicit	No
United Kingdom	Explicit	No
Regions (priorities set by the region)		
Lower Austria	Implicit	Implicit
Upper Austria	Explicit	Explicit
Flanders	Explicit/Implicit	Implicit
South Moravia	Explicit	Explicit
Lahti	Explicit	Explicit
Berlin/Brandenburg	Explicit	Explicit
Noord Brabant	Explicit	Explicit
Malopolska	Explicit	Explicit
Gwangju	Explicit	Explicit
Andalucia	Explicit	Explicit
Basque country	Explicit	Implicit

Prioritisation trends are on the rise, at strategic and implementation levels

Many countries and regions expect an increase in prioritization of policies in the future (Table 3.3). Those that have recently gone into such a process expect a deepening within existing broader priorities rather than a new process (e.g. Austria, Finland, Noord-Brabant) or increased prioritization of the policy mix to implement the priorities (e.g. United Kingdom, Berlin-Brandenburg). There were no cases of countries or regions planning to withdraw from a policy prioritization process.

Table 3.5. Expectations regarding future prioritisation process

Australia	⇨
Austria	⇧
Czech Republic	⇨
Estonia	⇧
Finland	⇧
Netherlands	⇨
Poland	⇨
South Korea	⇧
Spain	⇨
United Kingdom	⇧
Lower Austria	⇨
Upper Austria	⇨
Flanders	⇧
South Moravia	⇧
Lahti	⇨
Berlin/Brandenburg	⇨
Noord Brabant	⇨
Malopolska	⇧
Gwangju	⇨
Andalucia	⇧
Basque country	⇧

Explicit policy priorities are not easily encapsulated into traditional lists of research disciplines; technology fields; economic sectors. In many cases priorities are defined around societal challenges or lead markets, combining several research fields, technologies and economic sectors.

The respondents to the questionnaire were asked to classify their priorities according to research fields; technology domains and economic domains. It is not possible to present a harmonized summary of the responses using existing classifications:

- Priorities are often expressed in the form of societal challenges (ex. Healthy ageing), which span across research fields, technology domains and economic sectors;
- Variable combinations of technologies or research fields are prioritized (ex. ICT and life science; green technology and transport);
- "Priorities" in several cases are a way to organize funding sources into domains rather than a process of selection of certain fields, thus ending up in a full coverage of RDTI and economic activities in a country/region;[43]
- The level of detail of priorities vary: e.g. in some cases life science and health are presented as one aggregate priority while in other cases these are dissociated;
- Some priorities cannot easily be related to any of the existing categories (e.g. "knowledge society for all" or "solutions based on scarce resources" in Finland, "equipment for science and industry" in the Basque country);
- The classification of some "new" fields like design or creative industries into traditional research, technology and economic categories is notoriously problematic.

There is a large convergence of priorities into five broad fields loosely defined around: *1)* life science, biotech, health; *2)* ICT; *3)* Environmental technologies; *4)* mobility and logistics; *5)* new materials.

Despite the methodological difficulties, the exploitation of the responses given by regions and countries to the questionnaire reveals a very large concentration of priorities into 5 broad priority fields (Table 3):

1. Life science, biotech, biomedicine, pharma, health
2. ICT
3. Environmental and green technologies, renewable energies and energy management
4. Mobility, transport, logistics
5. New materials and nanotechnology.

Most regions and countries in the sample have defined their priorities in these broad fields, which also correspond to the areas that are prioritized in EU policies (Research Framework programme notably). A number of other broad priorities are shared by a more limited number of countries and regions, such as agrifood, production processes, optics, chemicals, etc. A minority of countries and regions include, within their top priorities, domains which do not pertain to the traditional high-tech sectors: creative and cultural industries, design and tourism. It can be noticed that those domains are also prioritized in regions with large high-tech capacity, such as Flanders or the Dutch country and region.

Table 3.6. Nature of priorities

Explicit priorities	Countries	Regions
Life science, biotech, biomedicine, pharma, health	Austria, Estonia, Finland, Netherlands, Poland, Spain, South Korea, United Kingdom	Lower Austria, Upper Austria, Flanders, South Moravia, Berlin&Brandenburg, Noord Brabant, Malopolska, Andalucia, Basque country
ICT	Austria, Estonia, Finland, Poland, Spain, South Korea, United Kingdom	Upper Austria, Flanders, South Moravia, Berlin&Brandenburg, Noord Brabant, Malopolska, Andalucia, Basque country, Gwangju
Environmental/green technologies, energy	Austria, Estonia, Finland, Netherlands, Spain, South Korea, United Kingdom	Lower Austria, Upper Austria, Flanders, Lahti, Noord Brabant, Malopolska, Andalucia, Basque country
Mobility, traffic, transport, logistics	Austria, Netherlands, South Korea, United Kingdom	Lower Austria, Upper Austria, Flanders, Berlin&Brandenburg, Noord Brabant, Andalucia, Basque country
Nanotechnology, materials	Austria, Estonia, Netherlands, Poland, South Korea	Lower Austria, Upper Austria, Flanders, Noord Brabant, Malopolska
Agrifood	Austria, Netherlands, South Korea, United Kingdom	Lower Austria, Flanders, Andalucia
Production processes, industrial equipment	Austria, United Kingdom	Flanders, South Moravia, Basque country
Services	Austria, Finland, South Korea	
Maths and chemistry	Austria	
Maths and engineering		Upper Austria
Optics		Berlin&Brandenburg, Noord Brabant, Gwangju
Chemicals	Netherlands	Flanders, Noord Brabant
Water	Netherlands, South Korea	
Design		Lahti, Noord Brabant
Creative sector	Netherlands	Berlin&Brandenburg
Heritage, cultural industries, tourism	South Korea	Flanders, Malopolska, Andalucia
Arts and humanities	Austria	

Prioritization mostly targets broad domain level rather than specialized niches of competitive advantages

In many cases, the explicit priorities are defined around the broad domains mentioned above. Concrete and specialized niches are not frequently presented as the objects of specialisation. A few exceptions are listed in Table 4. According to the interviews, many countries and regions that have defined broad domains of specialisation plan to transform the latter into more precise areas in the future years. This presents a key challenge ahead for policy-makers, and a necessity given the large degree of similarity in areas of "specialisation" of countries and regions that are competing on the same global markets.

Table 3.7. Examples of specific niches within broad priorities

Regions/ countries	Niches	Broad priorities
Lower Austria	Analysis of biological materials, and medical technology: agrobiotechnology and environmental biotechnology: Bioanalytics, environmental biotechnology, crop breeding, utilization of natural resources, pharmaceuticals; Blood purification systems, tissue engineering, cell therapy, cell biology and physiology, ICT visual computing, building physics and energy systems Materials, tribology (friction, wear, lubrication), medical technology, sensory technology and actuators, surfaces Green building Food safety Bioplastics	Life science, biotech, biomedicine, pharma, health ICT Environmental technologies, energy Nanotechnology, materials Agrifood
Noord Brabant	Smart Mobility, Solar&energy in built environment, Smart Materials, Homecare, Design	Life science, biotech, biomedicine, pharma, health Environmental technologies, energy Mobility, traffic, transport, logistics Nanotechnology, materials Design
Malopolska	In the area of safety and comfort of living: energetically self-sufficient construction, clean energy technologies as well as material engineering and nanotechnology for special use In the area of medicine and health: tissue engineering, drugs and technologies locally destroying cancer, monitoring and control of medical conditions and streamlining of the healing process based on the data analysis In the area of information and visualization: touchless computer interface, intelligent systems and universal access to information.	Life science, biotech, biomedicine, pharma, health ICT Environmental technologies, energy Nanotechnology, materials
South Korea	Seventeen New Growth Engines industries: Green technology industry New renewable energy Low-carbon energy Water technology LED application Green transportation system High-tech green city State-of-the-art fusion industry Media Communication fusion IT fusion system Robot application New materials and nano-fusion Biomedicine and medical devices High value-added food industry High Value-added service industry Global healthcare Global education services Green financing Contents and software Meetings, Incentives, Conventions and Events and tourism industry	Life science, biotech, biomedicine, pharma, health ICT Environmental technologies, energy Mobility, traffic, transport, logistics Nanotechnology, materials Agrifood Water Services

Priorities at regional and national levels are intertwined

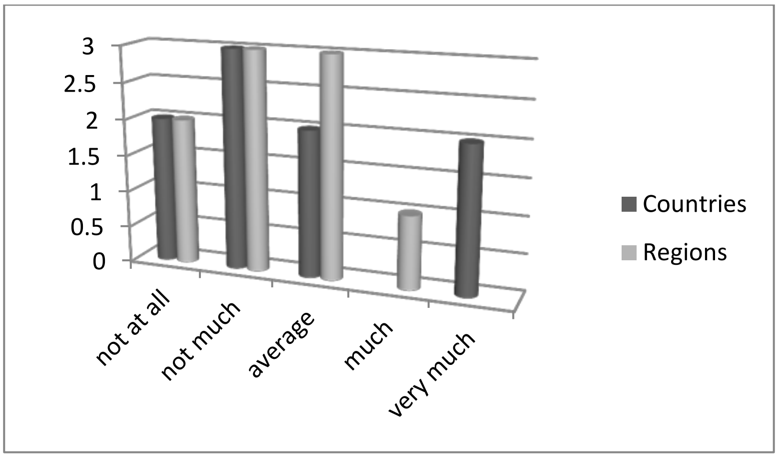
The intensity of interactions between the prioritization processes at play at national and regional levels is linked to the degree of autonomy of regions:

- Regional priorities influence national ones most strongly in Finland[44] and the Netherlands, two countries where the regions have relatively weak institutional powers. Figure 1 indicates that the majority of regions think that national priorities are not much influenced by their own choices, while more countries declare that national policy-making takes regional choices into account;

- The national level has the strongest influence on regional choices in Austria[45], Finland, the Netherlands, South Korea and the Czech Republic, again a set of countries where the regions have relatively weak institutional power (apart from Austria). Typical instruments are nationally-funded Centres of Expertise (Finland) or Centres of Excellence (Czech Republic) which shape the landscape of research and innovation potential across regions in some centralized countries. Flanders is an extreme case of a region which holds all powers to decide and orient its research, innovation and economic policy independently of the federal level.

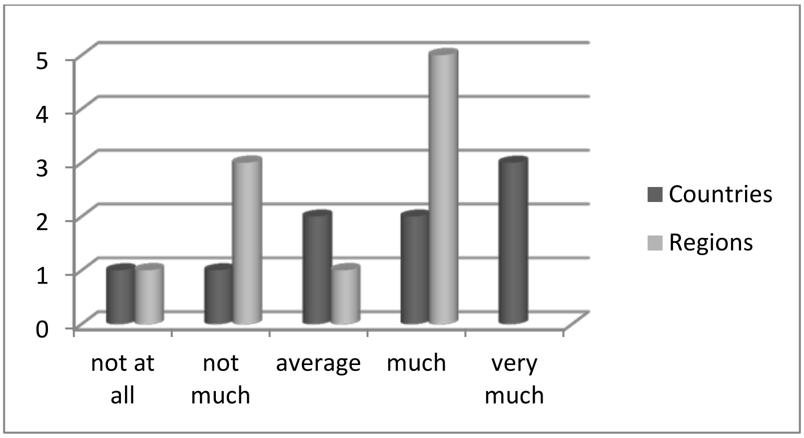
The alignment between national and regional priorities is fostered by a shared willingness from the authorities at those two levels in Europe, to align to EU priorities.[46]

Figure 3.5. The national level takes into account regional priorities when selecting national priorities



Note: Countries: 10 respondents. Regions: 11 respondents

Figure 3.6. The national level develops mechanisms to influence choice of priorities at regional level

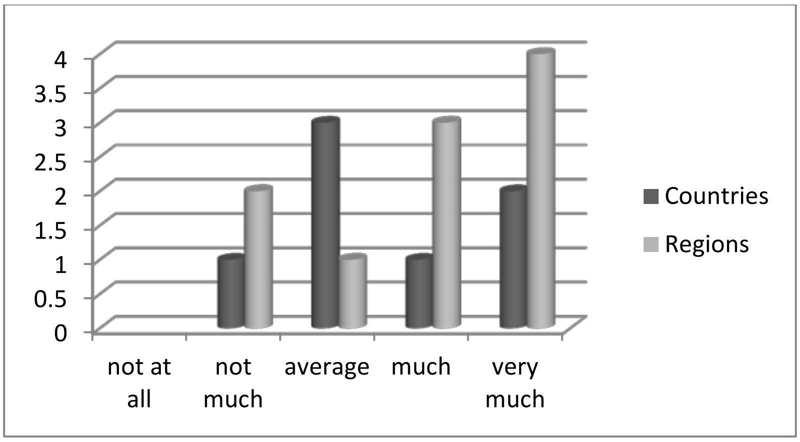


Note: Countries: 10 respondents. Regions: 11 respondents

The selection of RDTI and economic priorities are in many cases interlinked, more intensively so at the regional level

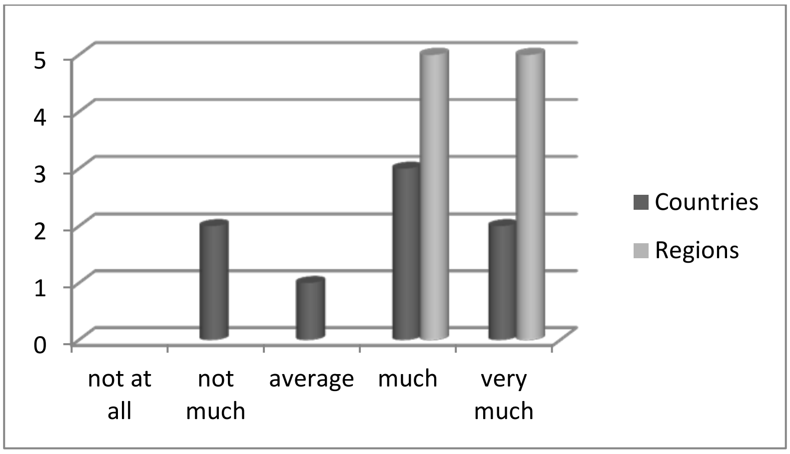
The distinction between "Research, development and innovation" and "economic" priorities tends to be artificial: in several cases, the definition of key priorities mixes the two types of elements[47]. Although the influence of one type of priority on the other goes both ways, the major influence seems to be from economic priorities to RDTI priorities, especially at regional level (Figure 3.6). Regions tend to emphasize these interlinkages more than countries (Figures 3.7 and 3.8).

Figure 3.7. RDTI priorities are taken into account when selecting economic priorities



Note: Countries: 10 respondents. Regions: 11 respondents

Figure 3.8. Economic priorities are taken into account when selecting RDTI priorities



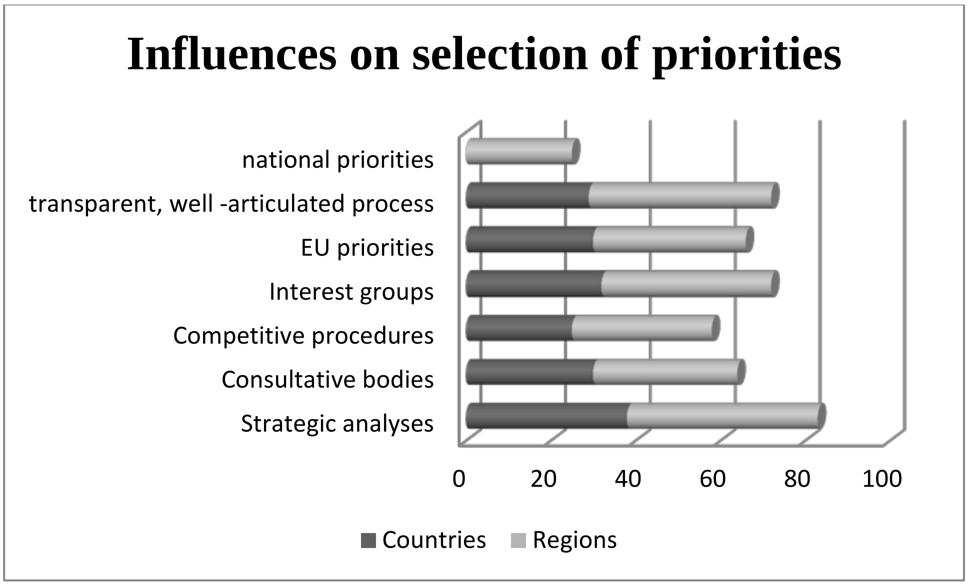
Note: Countries: 10 respondents. Regions: 11 respondents

Priority setting process

The selection of RDTI and economic priorities is influenced both by evidence and by the action of stakeholders

Overall, strategic analyses are declared as one of the most important influence on the selection of priorities, both for regions and countries (Figure 3.9). The influence of stakeholders, either individually through the action of interest groups, or collectively through the action of consultative bodies, is also a key vehicle through which the priorities are determined. Priorities set at higher level (EU priorities, national priorities for regions), influence the choices too. The only vector which seems a bit less common is the use of competitive procedures to elicit the priorities. Amongst all these sources of influence there is no clear difference between the process at play in regions or in countries.

Figure 3.9. Relative importance of various influences on the selection of policy priorities



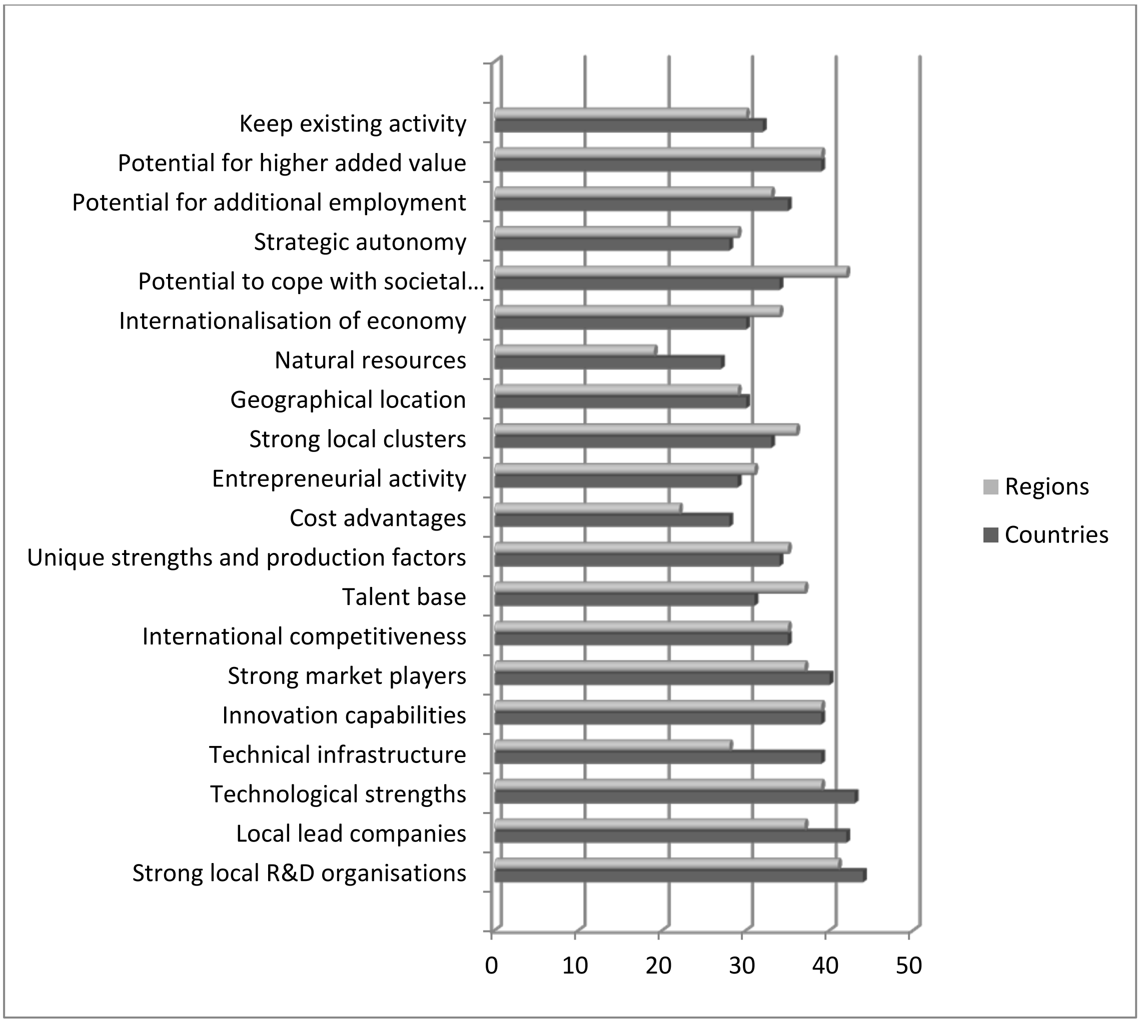
Note: Countries: 9 respondents. Regions: 11 respondents

The criteria used for the selection of RDTI and economic priorities capture RDTI and economic potential, both in the form of present and future "transformation" potential

Regions and countries tend to use a large set on non-mutually exclusive criteria for selecting their policy priorities (Figure 3.10). These cover RDTI potential as well as business potential. There is no clear dominance of one set of criteria. The criteria referring to more static advantages, such as natural resources or cost advantages are less important in the prioritization process. The assessment of potential to address future goals is as important as the assessment of current assets: the "transformation" potential of chosen priorities is reflected in the high priority placed on the criterion "potential for creation of higher added value activities". The potential to cope with societal challenges also features prominently in the range of criteria used for selecting priorities.

There is little difference between the criteria used by regions versus countries to define their priorities: regions tend to value a bit more their potential to cope with future challenges, and a bit less the natural resources and technical infrastructure. However the small size of the sample means that those differences are not significant.

Figure 3.10. Relative importance of a variety of criteria for the selection of policy priorities



Note: Countries: 10 respondents. Regions: 9 respondents

The cross-border dimension of strategies is in its infancy

Regions and countries define their priorities mostly from an internal perspective. In the case of Berlin and Brandenburg, but also for Lower and Upper Austria, an attempt is being made to define specialisation areas taking into account the cross-border dimension of specialisation areas, but this remains a marginal trend.

Transformation, modernization and diversification based on existing strengths are more frequent rationales than radical foundation of new domain of activities

The various rationales elaborated under the SMART SPECIALISATION concept – transition, modernization, diversification and radical foundation – are amongst the reasons mentioned in the enquiries' responses that underpin the prioritization process. They apply per priority area and not for the national/regional strategy as a whole.[48] Even at the level of individual priorities, a combination of those rationales is often stated.

The most frequent justifications are:

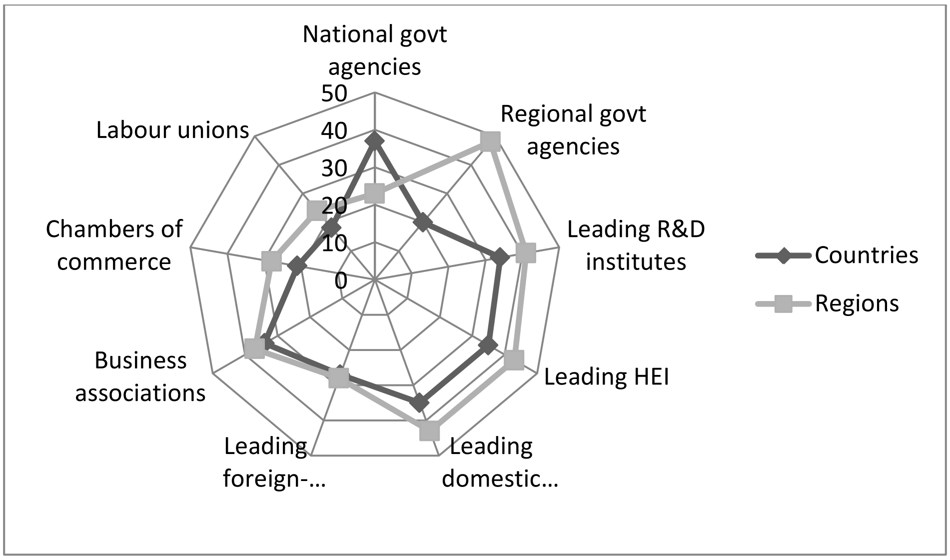
- Creating critical masses to raise the country's competitiveness while addressing societal challenges; finding new sources of competitive advantages, new growth engines;
- Reorienting the economy towards a knowledge-driven economy, ensuring renewal of the productive fabric both through transformation of existing companies/sectors and through the creation of new ones – developing all companies, not only those in high-tech activities;
- Supporting the use of pervasive technologies to irrigate the whole industrial fabric;
- Protecting the advances that the economy has in certain fields, extending those areas where the country/region is already strong, helping companies in those strong areas finding new niches of activities with large potential.

Overall the emphasis seems to be more on building on existing strengths to transform the economy rather than on creating completely new activities.

The priority setting process involves the triple helix of actors

Assessing the relative strengths of the actors involved in the selection process is fraught with difficulties as the answers depend on judgment of the interviewee in his/her own national or regional context: *e.g.* if lobby groups are the main driving force but there is a recent increase in the role of R&D institutes, the role of the latter may be overemphasized. The responses to the enquiry indicate that the main actors seem to be governmental authorities (from the region or the country), public R&D actors, and domestic companies (Figure 3.11). Other types of actors from the business side, such as foreign-owned firms, chambers of commerce or business associations, have less influence. Labour unions are the least important actors in the Smart Specialisation process both at regional and national levels.

Figure 3.11. Degree of involvement of types of actors in the selection of policy priorities



Note: Countries: 10 respondents. Regions: 10 respondents

Policy coordination mechanisms are highly context-specific

Few conclusions can be drawn from Table 5 that summarises the state-of-play in terms of bodies in charge of coordination and policy-making, within the RTDI field, and across that field and the economy. The frequency of use and roles of advisory bodies, high-level expert groups, hearings and polls, interministerial bodies, etc. varies considerably across countries and regions, and even between two regions in the same country (*e.g.* in Austria and Spain, the responses from the two regions from the same country are different).

In general, coordination mechanisms are more frequent within the RDTI field than across that field and the economic domain. Nevertheless, inter-ministerial bodies covering those two broad policy domains are widespread: it is however not possible through this enquiry to assess what role these play effectively to ensure coordination between policy areas, a notorious difficulty and a key success factor for smart specialisation strategies.

A few interesting insights on novel processes used at Smart Specialisation definition stage, can be drawn from the enquiry. In Poland and the Netherlands, the process involves citizens through web consultations; in Finland, the national level organizes "signal sessions" in regions to stimulate the identification of specific niches in line with national priorities; in the Netherlands and in Flanders, specific strategic bodies have been established for each identified priority area, which a strong presence of businesses.

Figure 3.12. Co-ordination and policy-making mechanisms and institutions

	Within the RDTI field			**Between RDTI and economy**			
	Advis. body	Strategic council	Round tables	Interminist. body	Advis. body	Strateg. council	Expert comm.
Countries							
Australia				C-P	C-P	C-P	C-P
Austria	C	C				C	C-P
Czech Republic	C-P	C-P	C-P	C-P	C-P	C-P	C-P
Estonia	C	C	C	C-P	C		
Finland	C-P	C-P	C-P	C-P	C-P	P	C-P
Netherlands	C-P		C-P	C	P		
Poland	C	C		C-P			C
South Korea	C	C	C	C-P	C	C	C
Spain	C			C	C	C-P	C
United Kingdom							
Regions							
Lower Austria	C	C	C	C	C	C	C
Upper Austria	C-P	C-P	C-P		P	P	P
Flanders	C-P	C	P	C-P	C-P	C-P	C-P
South Moravia	C-P	C-P	C-P				
Lahti	C-P	C-P	C-P	C-P	C-P	C	
Berlin/Brandenburg	C-P	C-P	C				
Noord Brabant		C-P	C-P			C-P	C-P
Malopolska	C	C	C	C	C	C	C
Gwangju	C					C	
Andalucia	C-P			C-P			
Basque country		C-P			C-P	C-P	

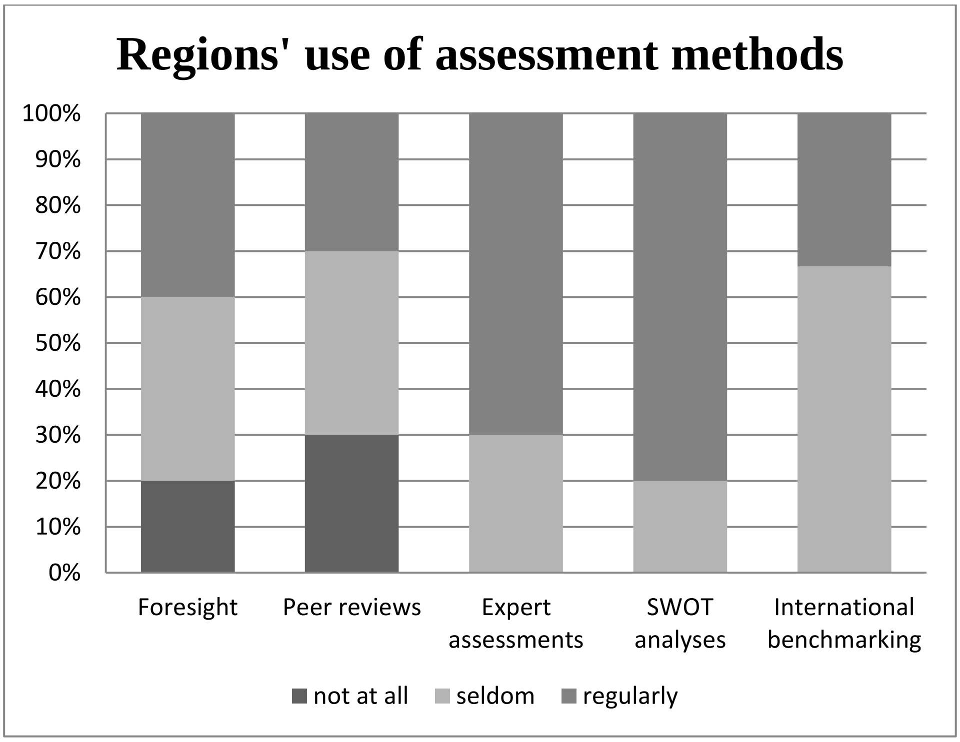
Note: C= coordinating role; P=policy-making role

SWOT analyses and expert assessments are the preferred methods to support the prioritization processes

Countries and regions use a variety of formal assessment tools to found their priority setting process (Figures 3.13 and 3.14). Amongst them, SWOT analyses are the most frequently used, both a national and regional levels. The preparation of programmes under the EU Cohesion policy (European Regional Development Funds, and European Social Fund) is often used as an opportunity to carry out SWOT assessments. Independent expert assessments are frequent too, and regions indulge more than countries in international benchmarking practices. Foresight is a more important tool at national level than at regional level: e.g. it is the main tool used in Poland but this country sees a growing use of peer reviews as a complementary assessment method.

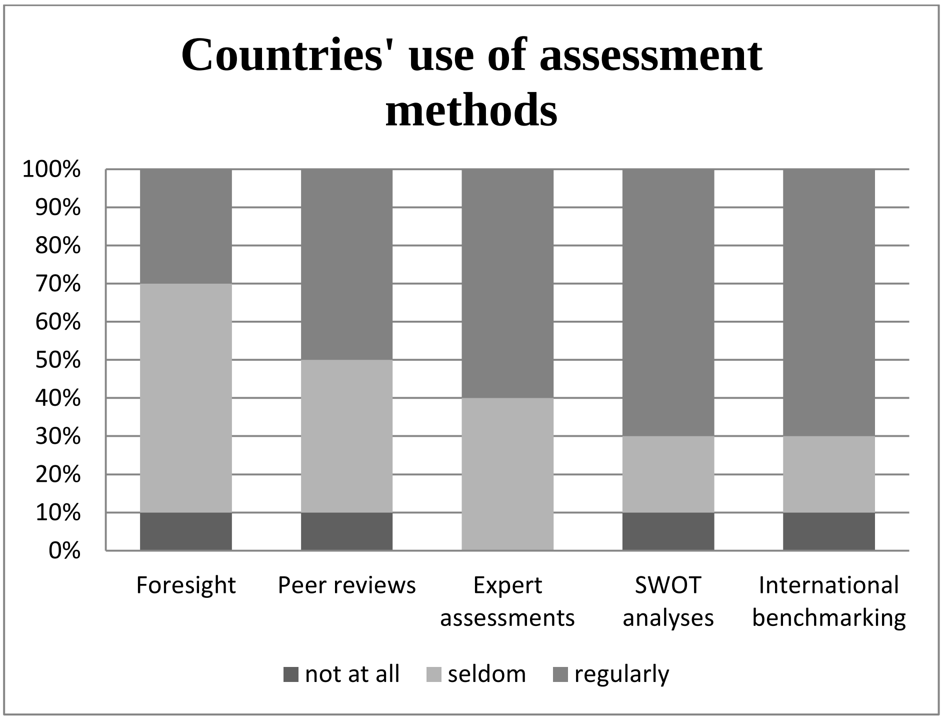
It is not possible through this enquiry to assess the quality and depth of the tools reported by the countries and regions. In all likelihood, exercises with very different scope and ambition are present under the same heading. The linkages between these exercises and actual policy-making, the independent character of the exercises, are also likely to vary a lot across countries/regions, and within them, across policy domains.

Figure 3.13. Importance of various types of formal assessment exercises by regions



Note: Regions: 11 respondents

Figure 3.14. Importance of various types of formal assessment exercises by countries



Note: Countries: 10 respondents.

Excerpts from the enquiries illustrate some qualitative aspects that lie behind the figures on frequency of use of assessment tools:

- *"There is a lot of programmes evaluation but not many of them actually influence policy";*
- *"The strategy is inspired by these studies but there is no direct clear link between the studies and the strategy";*
- *"There are SWOT analyses but they could be more robust";*
- *"There is a decoupling between studies/evaluations and policy-making. Some studies flow into the policy-making but this happens in the long term".*
- *"…distinctive ministries and individual offices organize panel brainstorming on future insights with external experts. The results are used as the basis for the strategic choices";*
- *"Often hard data give surprising results and are useful for policy-making";*
- *"There are no mechanisms to assess technological/economic SWOT on a regular basis, further specialisation rather happens on ad hoc based on companies' needs assessment (direct contacts between cluster management and companies), trend analyses, feasibility studies, etc.".*

Instruments and budgets

The policy priorities are hardly translated into policy instruments and hence, in public budget allocations

The link between policy instruments and the priority setting is not explicit in the vast majority of regions and countries. Hence it has proven difficult for many respondents to move from the "priority setting process" part of the enquiry to the "policy instruments and budget" part. A view on the policy mix through the lenses of the prioritization process does not exist in most cases.[49] Countries/regions were in their majority either unable to provide accurate responses or gave only rough guesses. It is therefore irrelevant to summarise the limited results collected through the enquiry in a harmonized way. In some cases, countries or regions have been able to give useful insights on the articulation between priorities and policy instruments and budgets.

In Noord-Brabant, "the strategic Plan Brainport 2020 aims at having an integral approach, gathering the whole value chains for each cluster: public and private R&D, good business location, networks, financing, acquisition, export and trade promotion, support to start ups etc." In the case of this region, public investments have been focused on the specific niches identified in the strategy: smart mobility; solar&energy in built environment; smart materials; homecare; design. The targeted policy instruments used to support the identified domains span across a whole range of policy domains (R&D, education infrastructure, FDI attraction…). These policy instruments are, by decreasing order of importance:

- Dedicated institutes;
- Dedicated cluster initiatives;
- Strategic investment support;
- Dedicated venture capital;

- Dedicated education and training;
- Regulations adapted to the goals;
- Specific research and innovation programmes;
- Innovation-driven public procurement policies;
- Support to international platforms and collaboration.

Accordingly, it is estimated in this region that more than 50% of both regional R&D and economy budgets are dedicated to the priority areas.

In Lower and Upper Austria, the main instruments used to support prioritised domains are quite similar to the above case:

- Dedicated institutes in the form of competence centres;
- Dedicated cluster initiatives;
- Priority access in general programmes in Lower Austria and specific research and innovation programmes in Upper Austria;
- Support to international platforms and collaboration;
- Infrastructure;
- Dedicated venture capital (more important in Lower Austria);
- Dedicated education and training;
- Regulations adapted to the goals (e.g. green building).

The two main instruments to support the prioritised areas in Lower Austria are clusters and technopoles: a calculation of their share in public budget is possible and ranges between 5% and 20% of total regional budget for R&D. But this figure does not include the other instruments listed above. In Upper Austria the estimation of the share of regional R&D budget going to prioritized areas is above 50% (the majority of it going to competence centres).

In Flanders, only regional instruments are used to support priority areas. They cover broadly the same types of instruments as the ones listed above for the Dutch and Austrian regions, with the addition of funds for support to spin-offs from dedicated competence centres. Innovation-driven public procurement is not yet used but a pilot framework exists. Taking into account only the funds allocated to strategic research centres, it is estimated that between 5% and 20% of total Flemish budget for R&D is dedicated to the priority areas. Given the larger set of instruments used to support these areas (mostly in an implicit manner) this share is, as in the above Austrian case, an under-estimation.

In Berlin and Brandenburg, the policy mix to support the explicit priority areas resembles that of the Austrian and Flemish regions. The transborder region uses both tools of priority access in general programmes and specific research and innovation programmes, but little dedicated venture capital and education and training programmes. A number of programmes set the membership of regional cluster as a condition for participation: this directs public funding preferentially to those areas officially selected in the joint strategy: health care-biotech-life science; energy; mobility-traffic-logistics; ICT-media-creative sector; optics.

Malopolska also uses a broad range of policy tools to support its priority fields: dedicated institutes and programmes, priority access in general programmes, support to international collaboration, cluster and sector policies; dedicated education and training programme and also strategic investment support as a major tool from the economic policy domain. But the estimation is that all those policy instruments only direct between 5% and 20% of total public R&D budgets, and between 20% and 50% of economic budgets, towards the prioritized areas.

The whole range of tools from both RDTI and economic policy domains are reported as being intensively used, without distinction, for the support of three prioritised areas in Andalucia: agrifood-bio; engineering-energy and engineering-aerospace. The Basque country reports a full and intensive use of all RDTI instruments for all priorities, whilst most economic policy instruments are used in a moderate way to support the priorities (with the exception of cluster policy, a major instrument).

In Finland, the national lead markets defined as priorities (inspired by the EU lead markets) are supported, in order of importance by:

- Specific research and innovation programmes;
- Priority access in general programmes;
- Cluster initiatives;
- Sector policies;
- Dedicated venture capital;
- Support to international platforms and collaboration;

And it is estimated that more than 50% of public funds is channelled to the priority areas, notably thanks to the Tekes, Centre of Expertise OKSE and Strategic centres for STI SHOK programmes.

In Poland, strategic research programmes, support for large R&D infrastructure and ERDF money for the innovation programme are the main vehicle for targeted public funding to prioritized areas, representing between 20% and 50% of total public R&D funding. However it is not clear whether these programmes capture the full set of policies contributing to develop the priority areas.

In South Korea, the "new growth engine" programme and the regional programmes account for 30% of total national budget for R&D, while it is not possible to calculate such a share for programmes under economic policy. At regional level, in Gwangju, contrary to other regions in the sample, the use of policy instruments differ from one area to another. The whole range of instruments is used to a varying degree of intensity.

As mentioned above, in countries and regions that have defined policy priorities, these are not unambiguously translated into instruments. It can nevertheless be noted that:

- Many countries and regions support dedicated institutes (such as the competence centre programme in Austria or the OSKE – Centre of Expertise programme in Finland) or targeted research and innovation programmes (such as Tekes programmes in Finland) which de facto channel public money preferentially to certain activity domains;

- Innovation-driven public procurement policies are seldom mentioned as types of instruments used to support prioritized areas (an exception is the United Kingdom where this is reported as one of the major instrument);

- Priority access in general support programs, for applicants active in prioritised areas is relatively rare, but some countries use a system of "bonus points" favouring this.[50]

The few responses given to the question of the share of EU Framework programme money dedicated to priority areas raise concern: in a number of cases, the respondents indicated that this share is higher than the national or regional share allocated to priority areas (this is the case *e.g.* for Poland and Flanders).[51] This indicates that national/regional funding is less concentrated on those strongest areas, as revealed by the EU competitive procedures. This is contrary to the expectation from the Smart Specialisation concept, which should result in a concentration of public support on the strongest areas.

Cluster policies are more prevalent at regional than national level.

Cluster policies are of two types: some fund generic activities such as cluster mapping and support to cluster development without designating priority areas (as in for example the Czech Republic) and others provide support to designated areas of activities. The latter are typical instruments used for targeted policies. They are present:

- At national level: in Finland, and with some instruments in the Operational Programme in Poland and in South Korea;

- At regional level: in Australian regions, in both Lower and Upper Austria, in Polish regions, Flanders, Berlin and Brandenburg, Noord-Brabant, Gwangju, Andalucia and the Basque country.

Monitoring and Evaluation

There is a big gap in policy intelligence tools – both for monitoring and evaluation- geared towards the prioritized policies

Targeted monitoring systems geared towards the implementation of "prioritized policies" are either under preparation (e.g. to monitor Top Sector policies in the Netherlands, or in Poland) or inexistent (in most of countries and regions surveyed). An exception is the United Kingdom that mentioned the existence of monitoring systems looking at the priority areas. The situation is more favourable in those regions which implement their policy mostly in the form of cluster policies: cluster monitoring and evaluation serve as a proxy for the monitoring and evaluation of smart specialisation (this is the case e.g. in Berlin-Brandenburg and the Basque country). A similar situation prevails in Gwangju where three industries are prioritized and followed-up with regular monitoring and evaluation plans.

Examples of monitoring systems incorporating a view on prioritized areas:

- Lower Austria: *"There is a balanced scorecard tool to monitor the regional strategy, one covers the clusters and the other one the Technopoles. It includes performance data such as publications, critical size, collaborative projects etc. The Monitoring helps to "fine-tune" the Strategy... Decreasing performance figures of the Wellbeing Cluster shown in the Balance Scorecard monitoring resulted in the decision to stop this cluster initiative."*;

- Noord-Brabant: *"the main instrument is the Brainport monitor, an annual report that analyses the region on about 40 statistical indicators on people, technology, business and basics. It contains trend analysis, benchmark with national average and, where possible other European Innovation Regions (Regional Innovation Scoreboard top 20). The monitor also includes an analysis of about 30 reports with qualitative and quantitative analyses on Brainport relevant topics like global location trends, raw materials, talent etc.";*

- Netherlands**:** *"A) Formulating indicators for general policy, specific instruments and specific economic sectors. B) Transparency: a 'follow the money' website. C) Dashboards that describe the ambition, goals, and activities for every sector, with corresponding indicators and target values."*

Insights on evaluation systems incorporating a view on prioritized areas are even rarer than for monitoring systems:

- Lower Austria*:"There are two evaluations to mention, covering the impacts of Clusters and Technopoles on value added, job creation, transformation of economic structure etc.";*

- Flanders: *"The management contracts with all organisations are evaluated at the end of their period. This includes a peer of the impact and the results of the organization under review. For some this is every 5 years (Imec, VIB, VITO, IBBT, VLIZ, etc), while for the excellence centres this is 3 or 4 years. Funding for projects also exists and this cycle runs with the evaluation cycle and may vary. Not all institutes have a detailed management contract; some receive a grant or a subsidy but in most cases there is some or a detailed evaluation that takes place".*

Conclusion and perspectives

The OECD TIP-Smart Specialisation governance enquiry shows that assessing governance mechanisms and outcomes in STI priority-setting and resource allocation is not a straightforward task. In many countries, smart specialisation strategies are at an embryonic stage, both from a policy development and deployment perspective. However, the survey also illustrates that countries, and even more so, regions, do increasingly engage in priority assessment and setting in the areas of science, technology and innovation. Moreover, the survey also suggests that resource allocation as a function of priorities chosen may form a basis for novel and relevant indicator development geared towards capturing both specialisation intentions and decisions.

The enquiry reveals a big gap between official prioritization, as enshrined in policy documents, and actual policy deployment: in this respect, it seems more important to look at actual policy mixes than at policy declarations and intentions. Big barriers seem to exist for such a translation process between policy documents and policy action. The enquiry points towards a number of causes for these barriers:

- The stickiness of public allocations to existing organisations, programmes, initiatives,… that prevents a shift towards new priorities;

- The fuzziness of the priorities, of which there are often different sets, and which sometimes are lists of possible intervention areas rather than genuine priorities;

- The horizontal fragmentation in policy-making (between traditional policy areas) which makes it difficult to produce holistic pictures of public action;

- The lack of means and tools to assess the relevance of certain actions to contribute to the priorities, when the latter are expressed in the form of societal goals.

Thus, another key challenge revealed by the enquiry is that of narrowing down broad "priority" domains – often inspired by European Union priority intervention fields in research – to real specialisation niches. Such niches should ideally respond to two criteria:

- Combining both economic and scientific-technological strengths: the enquiry showed that indeed both sets of criteria are declared as important selection factors and used simultaneously. Here the challenge lies in developing robust methods to assess the strengths on both fronts;

- Capitalising not only on the strength of existing assets but also on the future opportunities. This is probably the most difficult challenge, since the latter are less easily measured and captured by existing data or stakeholder action. Actually, the responses to the enquiry suggest that the approach followed puts much more weight on reinforcing existing strengths than on directing efforts towards future opportunities through instilling more radical trajectory changes.

To define these niches, the Smart Specialisation concept proposes to establish an entrepreneurial discovery process. This process ideally combines both smart user involvement (and crucially, business involvement in the strategy definition) and smart use of intelligence (in the form of studies, foresight, SWOT analyses, benchmarks, etc.). The enquiry showed that indeed both sources are used for the definition of the priorities. On both fronts there is a lot to be gained with improved methods and increased capacity on the side of decision-makers: the enquiry could not assess the relevance nor the quality of either user involvement or strategic intelligence. This is certainly the major area of improvement for efficient smart specialisation strategies in the future.

One interesting insight brought by the Smart Specialisation governance enquiry is the fact that strategies are defined according to administrative borders, rather than tuned to functional regions. However, a true smart specialisation approach, based on innovative niches, bears a good potential for de-fragmentation of policies: actors involved in these promising niches of activities are not likely to be confined within these administrative borders, and hence this calls for cooperation between authorities from adjacent regions and countries.

In the same vein, supporting these niches demands a synergetic approach from different fields of policies (research, technology, innovation, industrial policy, environment policy, education and training, etc.). This will help to broaden the traditional, linear-oriented innovation policies with demand-side instruments, such as public procurement policies oriented towards the promotion of innovation and the development of new markets, an especially relevant instrument in policies with a "transformative" goal.

Furthermore, as the niches will often have a localized nature due to agglomeration effects, instruments from regional and national levels will be relevant and need to interact efficiently. Hence the Smart Specialisation approach goes hand-in-hand with a de-fragmented policy approach, both horizontally and vertically.

The current immaturity and fuzziness of the Smart Specialisation concept calls for new policy intelligence. According to the enquiry results, the following actions seem relevant and timely:

- Development and testing of tools to conduct strategic analyses with the view to identify smart specialisation "niches" (rather than broad activity domains, too similar across countries and regions);

- Mutual learning and expert support to improve the stakeholders involvement process and the interlinkages between quantitative and qualitative inputs into strategy formation process;

- Development of monitoring and evaluation systems specifically geared to Smart Specialisation goals (in complementarity with generic monitoring and evaluation systems, which need improvement);

- Pilot exercises on implementing "Smart Specialisation-oriented" public budget pictures, as an effort to make the Smart Specialisation concept more tangible.

With respect to the first point, one ingredient that seems to be under-used in smart specialisation strategies so far is the involvement of external expertise in priority niches assessment. This is one of the directions to follow to counteract the influence of vested interests which are likely to dominate the policy choices today. Providing a neutral and evidence base to decision-makers to help them strike a balance between the various pressures from interest groups, is a necessary step on the road to Smart Specialisation strategies.

Concerning the second point, stakeholders involvement is difficult to organise with respect to "future" or emerging areas of activities, because by definition those domains are less well organised and have a lower critical mass that the traditional activities. Here the mingling between insights from enlightened entrepreneurs able to spot "weak signals", external experts, the involvement of users (to avoid falling into the trap of purely technology-push niches with dubious market potential), and prospective data and analysis will be particularly important to mobilise.

The generic arguments for the necessity of good, robust and policy-oriented monitoring and evaluation systems are of application here. They take a particular importance in the smart specialisation debate, because of the experimental character of these policies: without strong means to assess their value-added and effectiveness, there is an important risk of government failure: hence it is crucial that smart specialisation strategies develop into outcome-oriented policies and that, accordingly, policies are continuously being revised according to measured outcomes.

With respect to the last point, the absence of a clear view on public allocations to prioritized areas, as revealed by the enquiry, prevents policy-makers to assess the relevance and effectiveness of their policies. A good step to take would hence be to develop "Smart Specialisation-oriented" public budget calculations that would provide a picture of budgets allocated to each prioritized areas by aggregating:

- Budgets allocated to dedicated bodies and programmes (institutes, centres, R&D programmes, clusters…);

- Budgets allocated through preferential treatment in generic programmes;

- Ex post money received by prioritized areas in generic programmes.

At regional level, these budgets should include not only budgets from regional origin, but also national money flowing to the priority areas, and money of EU origin in the case of EU regions (in some cases Structural Funds are the main funding sources for innovation and economic policies in the regions).

To conclude, the results of the survey strongly underline the need to include a governance "process assessment" method into the toolbox that may underpin the design, deployment, follow-up and monitoring of smart specialisation strategies. Therefore: *i)* the questionnaire; *ii*) the survey method deployed; and *iii)* the insights obtained with the governance template, jointly add value to the further development of a Smart Specialisation policy "design and process" framework.

RIS3 KEY FOR SELF-ASSESSMENT

Armin Mahr, Federal Ministry of Science and Research, Austria, and
Christian Hartmann, Joanneum Research, Graz, Austria

The RIS3 KEY for self-assessment is an in-kind contribution from the Austrian Federal Minister for Science and Research with the CSTP Activity 2.4 on Smart specialisation strategies for innovation driven growth[52] carried out under the auspices of the OECD's Working Party on Innovation and Technology Policy (TIP). The KEY has been translated into seven languages: English, German, Spanish, Czech, French, Slovene and Serbian.

What is a RIS3 Strategy?

A RIS3 Strategy puts the concept of smart specialisation into practice. As the RIS3 GUIDE[53] highlights, designing a research and innovation strategy for smart specialisation – a RIS3 – starts with the adoption of a shared vision for the transformation of a regional economy towards a more competitive and more sustainable one in a long-term perspective. The core of this design process lies in the definition of priorities for knowledge-based economic development, identified on the basis of a region's unique strengths and potentials.

How can the RIS3 KEY for self-assessment help you to prepare your RIS3 Strategy?

The RIS3 KEY is a well-grounded and easy to use tool to unlock the idea of smart specialisation for regions, and to mobilise the regional stakeholders for the process of strategy making. It helps regions to develop their RIS3 Strategies by stimulating communication and permitting a quick first assessment of their status and potential that is needed to prepare a SWOT analysis as described in the European Commission's RIS3 GUIDE. It provides four sets of complementary questions that are addressing all relevant dimensions of a region‘s readiness and willingness to start or improve its RIS3 development process. Accordingly, the following dimensions of a region can be assessed: the enterprise sector, the science / knowledge & creative sector, the government sector and the regional innovation system as a whole – covering interactions between all three sectors.

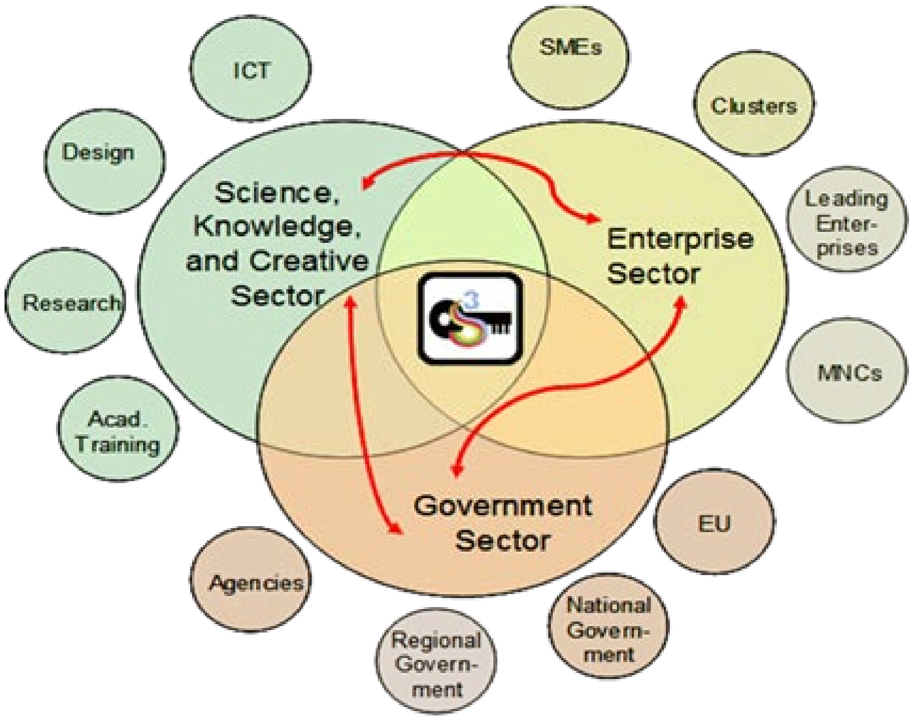
The RIS3 self-assessment KEY will help each region to prepare its next steps on the way to smart specialisation by:

- identifying existing strengths and opportunities for future development efforts,
- spotting remaining gaps and bottlenecks in the regional innovation system,
- mobilising the relevant institutions and actors to be involved in the RIS3 development process, and by,
- defining possible starting points for a region's RIS3 development process.

Who should use the RIS3 KEY for self-assessment?

The RIS3 process is smart when it mobilises the whole triple helix of a regional innovation system. The RIS3 KEY thus invites three lead groups to focus their competences and interests. These groups carry particular responsibilities for regional growth. Regional policy makers should initiate an informal assessment process and invite representatives from selected leading enterprises and lead institutions to go through the questions and report their results. Their co-operation is essential to identify a limited set of regional specialisations and develop a shared (and hence smart) vision and priorities:

Figure 3.15. The entire triple helix of the a regional innovation system



- **Regional leading enterprises and entrepreneurs:** The leading industrial players, Hidden Champions and key entrepreneurial innovators have the expertise on the market potential of new ideas, technology and knowledge, and the economic base that already exists in a region. It is their "entrepreneurial discovery" of promising fields, cross-checked by the science sector. Since smart specialisation addresses enterprises as drivers of innovation they should be invited to provide their insights and to share their perspective on the future regional innovation system.

- **Regional policy makers and implementers:** Members of regional governments and intermediary institutions are invited to organise such first self-assessments, to assess the governance sector of their region, to reconcile the expertise and interests of the two other groups and prepare a political RIS3 decision. This should cover all relevant government departments (enterprise, research, education, finance, etc.).

- **Regional lead institutions**: Representatives of the regional science, knowledge and creative sector (*e.g.* universities, research and technology organisations or innovation and design centres concentrate expertise on a region's specific knowledge profile). Lead institutions develop a region's skills & creativity potential, use and update research infrastructure, and push the region's science & technology frontier. They are therefore indispensable partners in selecting a limited set of challenges and economic fields where investment could upgrade the whole region's profile in global value chains. To make a RIS3 process smart, the regional lead institution's assessment of the region must complement the entrepreneurial discovery of regional innovation fields.

Guiding questions for self-assessment

Assessment of the status and potential of the enterprise sector

- What are your regional key economic sectors and in which sectors are innovation networks / clusters present in your region? How did these strengths evolve over the last 10 to 15 years?

- Which leading enterprises (*i.e.* large multinational firms and/or hidden champions and/or key entrepreneurial innovators) are situated in your region? Do they belong to the key economic sectors or are they situated in other sectors? How would you describe their structural involvement in regional planning / innovation policy development?

- How competitive are your regional economic key sectors compared to European or international rivals? What are their competitive advantages and how did they evolve over the last 10 to 15 years?

- Considering skills, expertise and knowledge: name up to three fields/challenges in which your region excels / has the potential to put itself on the map as a recognised world-class place of competence?

- Which technologies, products, and global market opportunities do you conceive as very promising for your regional economy in the upcoming decade?

- What upcoming threats and challenges do you see for the regional key economic sectors (and the regional economy as a whole) in the next decade?

- How internationalised is your regional economy (*i.e.* how export-oriented are the keys sectors, what is the level of foreign direct investment) – which sectors are most open in that respect? To which destinations do most exports go?

- Which economic sectors in your region are strong in R&D investment and technology development? Where do they get their new scientific and technological knowledge? From regional universities or from international R&D partners?

- Do local universities supply regional enterprises with ample graduates– or do regional employers need to look abroad for qualified personnel?

- How do you assess the climate for entrepreneurship in your region? Is it easy in your region to pursue innovative business ideas? Are people (incl. young people, university graduates, etc.) keen to start up their own business or do they rather prefer jobs in established enterprises or public sector? If not, what are the main barriers?

- Do regional research and innovation priorities and the type of support (grants, loans, guarantees, vouchers, business services, access to laboratories, qualified personnel, and cooperation partners, etc.) offered correspond to your needs? What would be a suitable incentive / condition for you to decide to invest (more) into research, development and demonstration activities (inside your firm, or out-sourced to other firms or to public R&D providers)? What budget do you intend to invest in joint ventures with universities and technology centres of the region?

Assessment of the status and potential of the science/knowledge and creative industries sectors

Considering both academic and non-academic skills, expertise and knowledge, name up to three fields/challenges in which your region already excels or has the potential to put itself on the map as a recognised world-class place of competence?

- What are the specific scientific strengths and research specialisations in your region (*i.e.* in which science fields are R&D investments, R&D personnel, publications, and patent applications concentrated)? Please name up to five. How did these strengths evolve in the last decade?

- Are these scientific activities competitive on a European or global level? Where are potential partners, where are the main competitors located?

- Which emerging new scientific competences (other than mentioned above) can be spotted in your region? Which research issues and future technologies do you conceive as most promising for the regional science / knowledge & creative sector in the next decade?

- Which lead institutions in the science / knowledge and creative sector (*i.e.* universities, research and technology organisations, innovation & design centres) are situated in your region? How would you describe their structural involvement in regional planning / innovation policy development? How do their strengths correspond with the regional economic specialisation and are they linked with the industrial base?

- How do your strategic R&D priorities correspond to the top priority themes of your region? Are regional investments from both public and private side in place to complement your own resources and attract co-funding and risk-sharing from the national (and, if applicable, EU) level in joint regional priority areas?

- What important research infrastructures and creativity hotspots are established in your region? What is their influence to create smart specialisations for your region? How can you benefit from nearby infrastructures/hotspots in other regions?

- How fit is your regional science/smart/creativity/skills base potential to address conjointly the grand challenges of society (health and ageing, climate change, urbanisation, energy, social inclusion etc)? How do regional lead institutions position themselves in global chains of knowledge and value (are they closely connected with institutions and companies in neighbour regions and internationally)?

- How favourable are working conditions for researchers in your region? How much mobility between the public science and the private sector does exist in your region (*i.e.* are graduates/engineers/ professors moving easily between universities and firms and back)? Do universities train scholars and graduates to become entrepreneurs?

- Does current academic education fit to the needs of the regional economy – do regional employers absorb graduates or are graduates forced to look elsewhere?

- How many permanent/temporary international research fellows, professors, and students do work in your region? What is the share of international staff in scientific/creative positions? How many co-operations with other international lead institutions does your region have?

Assessment of the government sector

- What is the strategic approach to regional growth and innovation policy in your region (do you already have a long term vision, written strategic concepts and priorities...)? If yes – which main objectives and priorities have been defined; how was this strategy process organised (e.g. open and participative or rather driven by experts)?

- Do you have an evaluation system for your regional growth and innovation policy – *i.e.* do you monitor regional growth and innovation policy programmes and measures regularly; do you conduct ex-post evaluations of past policy actions in your region? Are the evaluation results systematically used to inform policy decisions? Is there a specific mechanism in place? If yes - what main lessons have been learnt?

- What capacities do you have in your regional government for strategy development and priority setting? Could you set up a RIS3 policy development process with your own competencies and resources or would you have to involve external experts?

- Who is addressing innovation policy in your region (*i.e.* the EU, your national government, the regional government)? Are your regional innovation policy instruments well adjusted to instruments at other levels or do you see gaps and/or overlapping areas? Does the innovation support in your region cover only capacity building measures for innovation or also facilitate the emergence of demand for innovations?

- Besides science or technology driven innovation, which other forms of innovation / economic transformation are supported by your region?

- Do you have in your region autonomy for planning and budgeting innovation policy programmes and measures? If yes - how stable and predictable are public funds for innovation policy measures in your region?

- What is the budget allocated to research and innovation priorities in the next planning period, and what co-funding / risk-sharing scheme will be in place on the regional level? Which department(s) is/are in charge of innovation policies and budgets?

- Is your region part of a (larger) functional region? If yes - do you have established co-ordination mechanisms and processes with neighbouring regions?

- Does your regional innovation policy concept include a clear reflection/proposal on how to generate synergies between different European, national and regional funding sources, in particular between ERDF and the 7th Research Framework Programme, but also with other key programmes such as ESF, EAFRD and the Competitiveness and Innovation Programme and their respective successors?

- How does the strategy link to relevant European priorities in the field of research and innovation (e.g. ESFRI, take-up of Key Enabling Technologies, Digital Agenda, help addressing societal challenges, etc.)? Does your strategy take into account / seek cooperation with other regions/ countries and their innovation support systems and research facilities? To what extent can the innovation support provided by your region (e.g. vouchers) be used outside your territory and outside public RTDI support providers?

Assessment of the smartness of the Regional Innovation and Growth Policy Framework

- How well does the science / knowledge & creative sector interact with the regional economy (*i.e.* do you have industry-science co-operations in you region, privately endowed chairs at universities, joint research infrastructures, and/or pro-active technology transfers, contract research, living labs, student placement schemes, brokerage and technology demonstration events, share of regional business representatives in university management boards)? Which sectors are most active in this respect and where do you have potential for improvement?

- How do the government sector, the science / knowledge & creative sector, and the economic sector interact – e.g are strategic RTDI policy priorities set jointly? Is there a shared development of regional innovation strategies? Is there a shared regional innovation system governance?

- Is your existing regional innovation policy framework based on inter-departmental/inter-ministerial/ inter-agency co-ordination and co-operation covering relevant policies (in particular between research/science policies and, economic development policies, but also with regard to other relevant policies such as for instance education, employment and rural development policies)? Does it assess/take into account the existing level of policy co-ordination within the region?

- What are the main challenges your region will be facing in the next decade (economically, environmentally, socio-demographically etc.)? What are the main opportunities / emerging sectors? How can the regional enterprise sector and the science / knowledge & creative sector be mobilised to respond jointly to these challenges and opportunities?

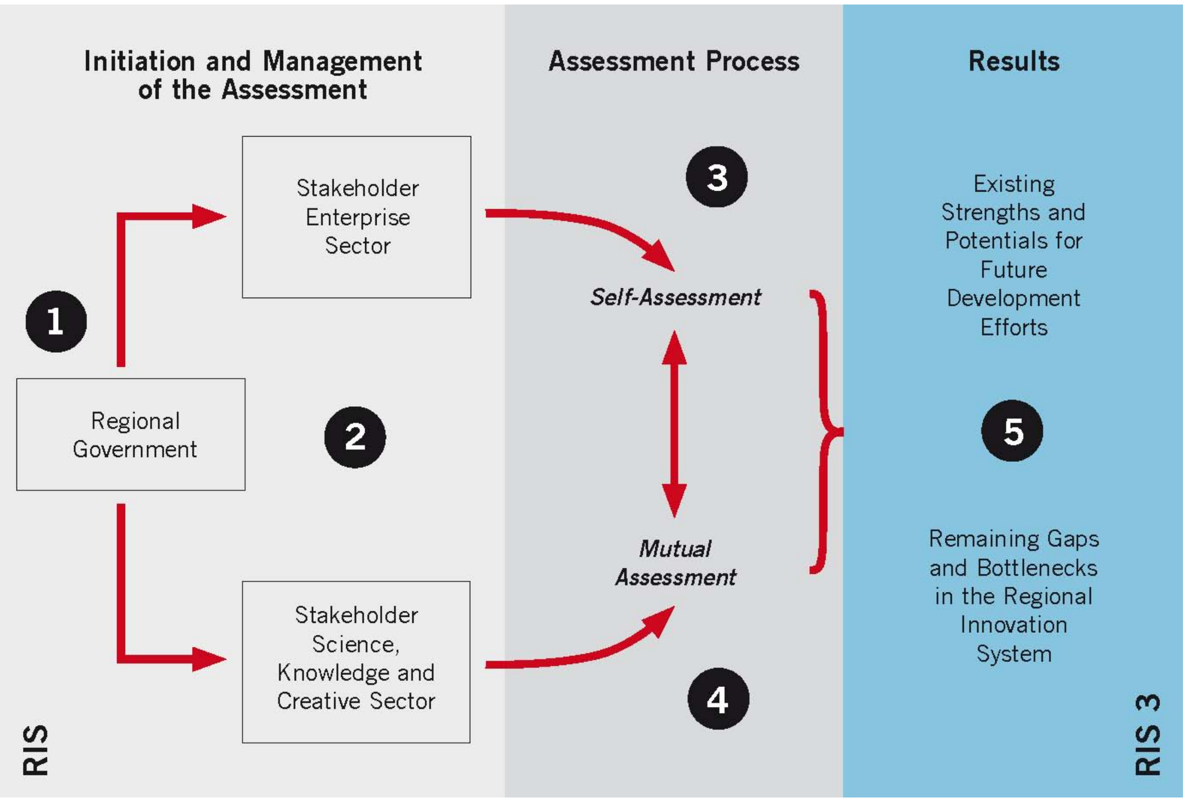
- What are the main challenges your region is facing with respect to RTDI performance (*i.e.* what are the major bottlenecks for a better overall innovation performance)? How can these bottlenecks be overcome by formulating and implementing jointly a RIS3 strategy?

- Do scientific, technological, creative or skills strengths and specialisations fit to your regional economic needs? Where is the best match – where do you see the strongest mismatch?

- Do perceptions of the enterprise sector and the science / knowledge & creative sector with regard to future promising technologies and products correspond?

- How do your regional strengths and specialisations match, complement and build upon the profiles of your neighbouring and partner regions? In which fields could enhanced crosssectoral co-operation create competitive advantages for an even larger region?

Figure 3.16. How to initiate a self-assessment process for smart specialisation using the RIS3 guide



Five steps to start a RIS3 strategy process for your region:

1. Initiate the self-assessment process and identify the relevant stakeholders in the enterprise sector and the science, knowledge & creative sector.

2. Prepare for the self-assessment: contact relevant stakeholders, distribute the guiding questions and organise necessary steps and milestones.

3. Perform an assessment of each sector by stakeholders stemming from the respective sector.

4. Perform an assessment of each sector with a mutual outside view (*e.g.* stakeholders from the enterprise sector assess the science and the government sector and vice versa).

5. Prepare a first SWOT analysis as starting point for the RIS3 process. Use identified strengths, weaknesses, opportunities, and threats for the development of a shared vision.

NOTES

38 Eurostat (2011), 'Patent Statistics at Eurostat: Methods for Regionalisation, Sector Allocation and Name Harmonisation', Methodologies & Working papers, Publications Office of the European Union, Luxembourg, 2011, ISBN 978-92-79-20237-7.

39 www.oecd.org/sti/innovationinsciencetechnologyandindustry/40794372.pdf

40 Report for the European Commission' – "*Measurement and analysis of knowledge and R&D exploitation flows, assessed by patent and licensing data*."

41 Extract from Polish questionnaire: "*The Ministry of Economy does not want to prioritise sectors. Taking into account the new strategic document, we could observe that Ministry of Economy prefers more horizontal approach and the selection of areas of specialisation is (or will be) based on bottom-up approach. Ministry of Economy prefers to talk about lead markets or key technologies i.e. identified in the project Insight 2030, rather than economic sectors".*

42 This answer seems questionable, since the Lower Austria region has implemented a policy structured around well-identified clusters and technopoles.

43 Extract from the Czech Republic questionnaire: "*The defined priorities of (applied) research and innovation … were set up as broad fields of science or industry, covering nearly the whole spectrum of scientific as well as industrial activities. The wide range of the priorities did not allow a targeted financing of public support to priority directions of the RDI. Moreover, these priorities are only very loosely linked to the broader socio-economic priorities and strategic interests of the Czech Republic. The National Policy of research, development and innovation of the Czech Republic was aware of the rather problematic situation and therefore one of its measures was to identify new priorities of applied research and innovation, which were to be designed with the aim of avoiding drawbacks of the current research and innovation priorities. Thus, in 2011 a process started, leading to identification of explicit priorities for research and innovation, which are closely linked to the overall socio-economic goals of broad development of the Czech Republic in terms of social, economic as well as environmental goals*".

44 Extract from the Finnish questionnaire: "*when the national and regional innovation strategies were first synchronized in 2008, the idea was to get regional authorities to disclose their strategy in the same terms as used in the national strategy and to encourage regions to reflect the future opportunities instead of their existing economic structure. Some regions like North Savonia use almost 95% of their EU Structural funds in line with those synchronized lead market themes*".

45 However the two Austrian regions disagree on this question, one stating a strong influence, the other one a weak influence.

46 Extract from Andalucian questionnaire: "*Our prioritized sectors and technologies are aligned with the national ones, as far as both of them are aligned and go in parallel with the European ones*".

47 Extract from Berlin and Brandenburg questionnaire: "*the 5 priorities are defined both in terms of R&I and economic development, the two are very much intertwined. Every cluster has an innovation core: the R&D field is included in the core of the cluster*". Extract from Dutch questionnaire: "*The Top Sectors Approach is an integral approach that spans through both R&I and economic domains*".

48 Extract from the Basque country questionnaire: "*The main driving force is to replace declining industries by new industries with future potential. The rationales are different according to the industries:*

- *Reinforcing the strong ones (automobile suppliers, energy)*
- *Modernising and diversifying existing industry into new activities (steel and metal working, traditional manufacturing)*

There is a different strategy for each sector: Biobasque; Nanobasque; Energybasque…. The market perspective is the driving force."

49 Extract from the Austrian questionnaire: « *Difficult to say because the 10 areas are not clearly linked to instruments and funding channels. For confidentiality reasons, an ex post analysis of funding allocated per area is not possible. The research projects categories do not correspond clearly to the 10 areas. This problem exists for the next questions, which cannot be answered.”* Extract from the Estonian questionnaire: “*The difficulty lies in the inertia of the budget: most of it is allocated to fixed elements so there is not much room for change. Strategy-making process is not linked closely enough to the budgetary process*”.

50 In Estonia, bonus points for priority fields are granted in ERDF programmes, but not in national programmes.

51 In the case of Flanders this might be explained by an under-estimation of the share of the regional budget dedicated to priority areas.

52 Referred to in the 2011-2012 PWB as “Report on global knowledge and innovation networks and policy implications for national specialisation in research and innovation”

53. http://s3platform.jrc.ec.europa.eu

Glossary of terms of the RSI3 for self-assessment guide

Competitive Advantage: An advantage that a firm has over its competitors, allowing it to generate greater sales or margins and/or retain more customers than its competition. There can be many types of competitive advantages including the firm‘s cost structure, product offerings, distribution network and customer support.

COSME: Programme for the Competitiveness of Enterprises and SMEs 2014-2020

EAFRD: European Agricultural Fund for Rural Development

ERDF: European Regional Development Fund

ESF: European Social Fund

ESFRI: European Strategy Forum on Research Infrastructures

Hidden Champions: Small but highly successful companies, concealed behind a curtain of inconspicuousness, invisibility and sometimes secrecy

Horizon 2020: EU Framework Programme for Research and Innovation

Lead Institution: Universities, research and technology organisations, innovation & design centres that are shaping the regional knowledge base and skills help to unleash the innovative and creative capacity of a region.

Leading Enterprise: A regional enterprise that is characterised either by a size well beyond the regional average and is being successfully active on international markets or by being highly influential for the region‘s innovative (creative) potential.

R&D: Research and Development

RTDI: Research, Technological Development and Innovation

SWOT: A strategic planning method used for evaluating projects on the basis of their Strengths, Weaknesses, Opportunities and Threats.

Triple Helix Model of Innovation: Academia, government, and industry constitute the three helices that engage in triple helix innovation. Educational institutions of higher learning (colleges and universities) primarily represent academia in this paradigm. However, educational institutions at other levels are not precluded from contributing to, and participating in, triple helix innovation processes. Government may be represented by any of the three levels of government and their owned corporations: National (federal), regional (state), and local (municipal). There are no restrictions on the types of industry (firm) involvement in triple helix innovation processes: *i.e.* private corporations, partnerships or sole proprietorships may represent industry.