2 Broadening innovation policy for regions and cities

This chapter discusses the need to move from a narrow focus in innovation policy to a broad-based approach that adapts to the needs of different regions and cities. A broad-based approach requires taking capacity of the regional innovation system into account and adapting efforts of all levels of government to working with and upgrading that capacity. As regions and cities across the OECD have to face today's grand societal challenges, business-as-usual approaches are unlikely to deliver innovation in all places.

Introduction

Weaknesses in technology and knowledge diffusion are weighing on regional innovation and productivity growth, particularly for firms in regions distant from the innovation frontier. A few regions lead innovation in a progressively more complex environment. They expand the global knowledge frontier and thrive as innovation supports the creation of new jobs and productivity growth. Other regions are struggling to adapt their economies and are increasingly at risk of facing prolonged increases in unemployment due to automation (OECD, 2018[1]; 2015[2]) or to job losses in traditional industries.

In one-third of OECD countries, productivity growth has been concentrated in a single, already highly productive region that usually includes the country's largest city. On average, productivity in the least productive region in a country is 46% lower than in its most productive region (OECD, 2019[3]). Between 1995 and 2013, the gap between the top 10% OECD regions with the highest productivity and the bottom 75% has grown on average by almost 50% (OECD, 2016[4]) and between 2000 and 2016, 14 out of 31 OECD countries had more than half of their productivity growth coming from the already most productive "frontier" regions (OECD, 2019[3]). While innovation is essential for productivity growth and sustained economic development, pursuing innovation activities is becoming increasingly complex and costly (Bloom et al., 2017[5]; Gordon, 2017[6]).

At the same time as innovation and technological progress seem to slow, disruptive innovations are fundamentally changing how OECD economies function. Shared mobility, the rise of micromobility solutions and platform-based short-term rental have already changed the inner cities of many OECD metropolitan areas. Free-floating bicycles and e-scooters line the sidewalks and trial runs of autonomous drones delivering parcels or take-out have started.[1] Private-to-private rentals via online platforms challenge the hotel industry, the same as ride-sharing applications challenge the traditional taxi market, both also affecting prices in the rental market.[2] Digitalisation and the growth of "big" data, as well as the tools available to analyse it, open new opportunities to all types of firms to gain a competitive edge.[3]

Disruptive innovations might be a challenge for regulators and planners but they might also be necessary to address the grand societal challenges that OECD economies are facing. Beyond the slowdown in productivity growth, OECD countries will have to take strong mitigation and adaptation measures to combat climate change, will have to ensure functioning and sustainable economies in the face of rapid ageing and look outward to ensure that globalisation and the growing role of emerging economies create benefits for all and not just a select few firms or individuals (OECD, 2018[7]; 2019[3]).

As the nature of innovation in regions and its underlying factors change, traditional innovation policies may be too rigid and narrowly focused. Innovation policies systematically aim to stimulate firms' research and development (R&D) activities while overlooking that R&D and technological development are not the only sources of innovation. In the context of the Smart Specialisation Strategies (S3) framework, additional factors should feed into "entrepreneurial discovery" strategies in order to identify key opportunities and bottlenecks to regional innovation. To ensure that all regions benefit from innovation, regional policies need to be broadened, taking into account additional drivers of innovation, such as embedded R&D or management and production capabilities.

Simply copying and applying policies locally because they were successful elsewhere can have serious drawbacks. If the underlying conditions that led to policy success elsewhere are not present locally, such policy is likely to fail, or not even progress from the design to the implementation phase. Moreover, some regions were successful in the past but are now facing difficulties in adapting to the latest industrial transitions. Therefore, if less-developed regions copy policies that were successful in the past for regions currently in industrial transition, the former can also end up struggling to manage the latest or future industrial transitions. Ultimately, well-design policies require learning from best practices and finding how to match or adapt such practices to local contexts.

Decentralising policymaking to local actors can contribute to better adapt policies to regional characteristics. Decentralisation is an increasing trend across OECD countries that will require breaking silos across different layers of government and policy areas. National governments remain leading players in designing and implementing innovation strategies, thus the decentralisation trend will require strengthening policy coherence across different layers of government to enable complementarities and avoid inconsistencies. Furthermore, as the factors and nature of innovation become more multidisciplinary and complex, policy co-ordination is also required across different policy areas such as education and skills, or global value chain (GVC) participation. An additional level of complexity is that some policy areas can be managed locally, such as incentives for innovative collaborations and training, while others will remain managed nationally, such as intellectual property rights, competition policy or education policy (with exceptions in some OECD countries).

Addressing potential adverse social impacts of technological breakthroughs without jeopardising the pace of technological development itself, will require policy coherence between innovation and other policy areas such as social policies. With fast-paced technological innovations, for example, in robotics and artificial intelligence, an increasing number of tasks are becoming automated. This enables productivity growth but also poses the risk of displacing several human jobs, which can increase unemployment and amplify inequalities. Innovation policies may need co-ordination with social policies to address these concerns, for example, fostering skills' upgrading through specialised training programmes and mobilising "left-behind" populations to participate in regional innovation policymaking (Pyke, 2018[8]).

This chapter and the whole report draw from a series of expert workshops on "What works in innovation policy? New insights for regions and cities" organised by the OECD and the European Commission (EC). For each workshop, experts provided background papers that, together with the discussion during the workshop, form the basis for this report:

- Fostering innovation in less-developed regions, with papers by Slavo Radošević (2018[9]) and Lena Tsipouri (2018[10]).
- Building, embedding and reshaping GVCs, with papers by Riccardo Crescenzi and Oliver Harman (2018[11]), and Sandrine Labory and Patrizio Bianchi (2018[12]).
- Developing strategies for industrial transition, with papers by David Audretsch (2018[13]) and Charles Wessner and Thomas Howell (2018[14]).
- Managing disruptive technologies, with papers by Pantelis Koutroumpis and François Lafond (2018[15]) and Jennifer Clark (2018[16]).
- Experimental governance, with papers by Kevin Morgan (2018[17]) and David Wolfe (2018[18]).

Innovation policy and innovation systems

Traditionally, innovation policy is often part of a science, technology and innovation package. This combination can miss the distinctive features of innovation that go well beyond progress in the important field of science and technology. In particular, to support "catching up" of places that are lagging within a country, it is often more effective to focus on adopting ideas, inventions or even innovations developed in other parts of the country or even outside the country rather than trying to directly move towards the innovation frontier.

What is innovation (policy)?

The *Oslo Manual*, published jointly by the OECD and Eurostat, provides guidelines on how innovation can be measured. The 4th edition of the OECD/Eurostat manual (2018, p. 60[19]) defines "innovation" as:

> *An **innovation** is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).*

The definition sets out a broad notion of "innovation". It goes beyond a sole focus on business sector innovation by using the term "unit", which can cover private individuals or public sector agencies. An essential element for innovation is that it derives from knowledge-based activities and that it is novel. Underpinning the innovation activity is the goal of value creation or value preservation (albeit the actual realisation of economic or social value might not arise as innovation outcomes are uncertain). Innovation distinguishes itself from other concepts (such as inventions) as innovations need to be implementable, i.e. an innovation needs to be put into use or made available for others to use (OECD/Eurostat, 2018[19]).

The activities in which firms engage in order to develop innovations are as broad as the definition of innovation. They include R&D and engineering, but also design and other creative activities. Beyond the activities directly involved in the development of products, services or processes, innovation activities also include marketing and brand equity activities (i.e. those activities that raise the public value of a brand), as well as activities related to firms' intellectual property (protection and exploitation). Firms also conduct activities that support innovation, such as employee training, software development or database-related activities (including data analysis) and the purchase (or lease) of tangible assets. Finally, innovation itself can require direct formal management arrangement or informal setups (OECD/Eurostat, 2018[19]).

Innovation policy has continuously evolved, as the focus on "innovation" as a standalone concept increased. Traditional policy efforts affecting innovation would not necessarily fall under the heading of innovation policy. Since the 1990s, the concept of "innovation policy" has become increasingly used as a separate moniker (Edler and Fagerberg, 2017[20]). The lines between science, technology and innovation policy for example remain and are often blurred. The renewed interest in industrial policies in Europe often includes a strong focus on innovation, e.g. the United Kingdom's Industrial Strategy set out to invest GBP 725 million through its Industrial Strategy Challenge Fund to "capture the value of innovation" (BEIS, 2017[21]).

The classic approach to innovation policy is "invention-oriented" but this approach has increasingly been complemented with system- and mission-oriented innovation policies. Invention-oriented innovation policy tends to focus on the R&D and invention-related aspect of innovation often supported by dedicated public bodies (e.g. research councils). Mission-oriented innovation policies set out specific goals that innovation is meant to achieve, which means that policy does not target an individual step in the innovation process but the whole process to ensure that progress leads towards a path in line with the mission statement or towards achieving the goal. System-oriented innovation policy stresses the importance of links between different actors and focuses on the innovation system as a whole. Among OECD countries and in OECD reviews of innovation policy, this approach has been popularised since the 1990s (Edler and Fagerberg, 2017[20]).

The different types of innovation policy reflect the evolution of the rationale for public intervention. Market failures are at the heart of traditional innovation policy. Benefits from basic research, for example, tend to be universal and difficult to commercialise, which means that firms underinvest. Certain firms might not have the (*ex ante*) financial capacity to invest in R&D or acquiring knowledge or information might be too costly to the individual firm, but worthwhile when firms share the effort. Invention-oriented policies address such market failures. However, they do not address systemic failures of the innovation system as a whole. This is the view in the innovation systems approach, which also puts a greater emphasis on the public sector as a key actor (and facilitator), as well as acknowledging the role of other non-market actors (e.g. foundations or private individuals) rather than relying on the market to produce innovation.

The need to address grand social challenges is a rationale for a mission-oriented innovation policy approach. The aim of mission-oriented innovation policy is to redirect technological change from existing trajectories towards more economically, socially and environmentally beneficial paths. It thereby moves

beyond trying to fix market failures but aims to solve broader "grand challenges" or achieve ambitious global projects, such as the sustainable development goals (SDGs). In pursuing "mission-oriented" innovation policy, governments are also aiming to work more closely with the business sector and civil society to ensure that technological progress moves in the direction of shared goals (OECD, 2018[7]). For example, creating incentives to align innovation efforts with SDGs has the potential to enable new forms of technological development that address grand societal challenges, such as poverty, ageing or climate change.

The concrete instruments used in innovation policy are not bound to a specific type of innovation policy. Instruments fall into two major groups, those that target the supply of innovation and those that target demand for innovation. Supply-side instruments are more traditional measures and include direct (fiscal) incentives and support, for example, training and skills development, provision of innovation infrastructures or advice services. Demand-side measures have increased in popularity in recent years. Demand-side instruments stimulate innovation through "pull" factors that take different forms. Regulation or standards can create framework conditions that induce firms to innovate. Another tool is the strategic use of public procurement to foster innovation. However, with few exceptions, experience in OECD member countries shows that the use of such policies remains limited to areas in which societal needs are not met by market mechanisms alone, e.g. health, environment, or in which private and public markets intersect, e.g. energy supply and transport (OECD, 2011[22]).

National and regional innovation systems

The focus on innovation policy is increasingly turning towards creating and nurturing support systems and infrastructures that help increase technological absorptive capacities. The emphasis moved from disseminating advanced manufacturing technologies and addressing internal obstacles to technology diffusion at the firm level, to supporting system-oriented and integrated approaches in innovation.

Three elements underpin most definitions of "innovation systems", the actors within the system, the networks that connect them and the institutions integrated within the system. Actors are firms in the private and public sector and the supporting infrastructure that includes educational institutions, research centres, public bodies and other agencies. The network between those actors facilitates the flow of knowledge that can be facilitated (or hindered) by the institutional framework, which includes formal rules and informal norms within the network (Isaksen, Martin and Trippl, 2018[23]). Earlier definitions of (national) innovation systems included the general elements but often used the term "institutions" as a catch-all replacement for "actors" (Box 2.1).

Box 2.1. Early definitions of national innovation systems

The concept of national innovation systems rests on the premise that understanding the linkages among the actors involved in innovation is key to improving technology performance. There is no single accepted definition of a national system of innovation. What is important is the web of interaction or the system, as reflected in the definitions used in the academic literature.

A national system of innovation is…:

- "... the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies" (Freeman, 1987[24]).
- "... the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge [...] and are either located within or rooted inside the borders of a nation-state" (Lundvall, 1992[25]).

- "... a set of institutions whose interactions determine the innovative performance [...] of national firms" (Nelson, 1993[26]).
- "... the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country" (Patel and Pavitt, 1994[27]).
- "... that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies" (Metcalfe, 1995[28]).

Source: OECD (1997[29]), *National Innovation Systems*, https://www.oecd.org/science/inno/2101733.pdf.

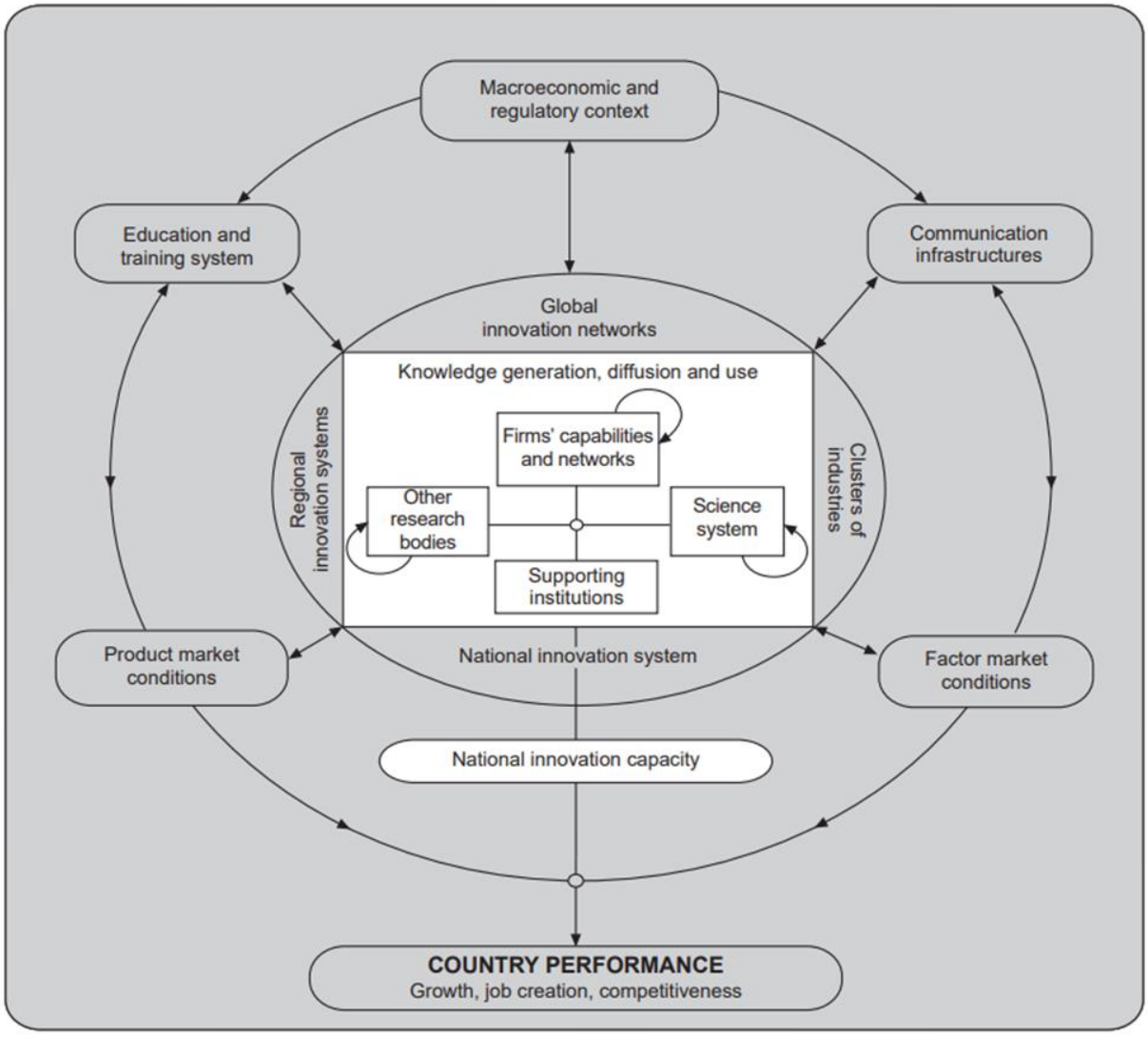
Considering the innovation system, rather than focusing on individual actors, acknowledges the importance of the links between the actors within the system. A country or region can have all the individual pieces associated with strong innovation performance, e.g. global firms, a university, technology transfer offices, research centres, etc. but progress might be slow or inexistent. From an innovation system point of view, this would be a systemic failure that traditional innovation policy does not address. Policy needs to address the capacity of individual actors (including the public sector) and assess and foster the relationships between actors. Incentives often encourage exactly the opposite behaviour. Universities target global leaders (rather than local firms) for collaborative efforts, academics' careers in some countries are solely driven by academic publications and commercialisation of research actively discouraged, subsidy schemes reward the creation of jobs rather than promoting competitiveness, etc.

OECD work has long focused on assessing innovation systems as a whole. At the heart of the (stylised) innovation system is not just a national innovation system but the combination of a country's regional innovation systems, its embeddedness in global networks and its sectoral clusters (Figure 2.1). The importance of regional or local systems is, however, not universally acknowledged (e.g. Cirera and Maloney (2017[30]) use a framework focused purely on the national level).

Two concurrent phenomena have strengthened the role of regions in the innovation system. The first is the inclusion of regions and their specific assets in national innovation policy, the second a paradigm shift in regional development policy from a subsidy-oriented model to policies that invest in local assets and unlock growth potential (OECD, 2011[31]). The move towards less direct interventions at the national level and innovation policy shifting towards framework setting and regulations has also provided more space for regional policy (Laredo, 2016[32]). Regions and cities can leverage their links with local firms to better tailor policy to local needs and capacities and support firms in leveraging the innovation framework that has been set by higher levels of government.

With large regional disparities in terms of innovation performance, local characteristics increasingly matter for policy success. Ready-made policy solutions are likely to fail in the implementation stage. Adapting to regional contexts is at the core of Smart Specialisation Strategies (S3s – see Box 2.2) that are part of the European Union's Cohesion Policy. Many factors supporting innovation have an important spatial dimension, requiring policies to avoid one-size-fits-all policy solutions and to adjust to the specific local challenges and opportunities regions face. For example, what works for low-income regions is inherently different from what works for regions at the technological frontier.

Figure 2.1. Actors and linkages in the innovation system



Source: OECD (1999[33]), *Managing National Innovation Systems*, https://dx.doi.org/10.1787/9789264189416-en.

Box 2.2. Smart Specialisation Strategy (S3)

Smart specialisation strategies are at the heart of the European Union's Cohesion Policy – this integrated, place-based approach is the main European Union (EU) policy instrument to address structural changes linked to industrial, digital and green transition. Smart specialisation plays a key role by supporting all regions and EU member states to activate their potential for innovation, competitiveness, sustainable jobs and sustainable growth through S3s.

An S3 should be designed around the following key principles:

- Smart specialisation is a **place-based approach**, meaning that it builds on the assets and resources available to regions and EU member states and on their specific socio-economic challenges in order to identify unique opportunities for development and growth.

- To have a strategy means to **make choices for investment**. EU member states and regions ought to support only a limited number of well-identified priorities for knowledge-based investments and/or clusters. Specialisation means focusing on competitive strengths and realistic growth potentials supported by a critical mass of activity and entrepreneurial resources.
- **Setting priorities** should not be a top-down, picking-the-winner process. It should be an **inclusive process of stakeholders' involvement centred on "entrepreneurial discovery"** that is 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 this potential.
- The strategy should embrace a **broad view of innovation**, supporting technological as well as practice-based and social innovation. This would allow each region and member state to shape policy choices according to their unique socio-economic conditions.
- Finally, a good strategy must **include a sound monitoring and evaluation system** as well as a revision mechanism for updating the strategic choices.

Efficient smart specialisation should prioritise domains, areas and economic activities where regions or countries have a competitive advantage or have the potential to generate knowledge-driven growth and to bring about the economic transformation needed to tackle the major and most urgent challenges for the society and the natural and built environment. The number and nature of these priorities will vary from region to region. While a first set of priorities should be identified when the S3 is designed, they can be changed or modified when new information or broader developments make it advisable.

Source: EC (2020[34]), *What is Smart Specialisation*, https://s3platform.jrc.ec.europa.eu/en/what-is-smart-specialisation- (accessed on 30 June 2020).

Broadening regional innovation policy

Regional innovation policy cannot be reduced to R&D-based interventions but in many instances, R&D is a, if not the, key focus of innovation policy. R&D accounts for only a small part of innovation activities taking place in regions. Only 2 500 companies account for about 90% of global R&D spending in the private sector in 2018. Even among the 2 500 companies, R&D spending is concentrated among the biggest investors with the top-100 companies contributing more than half of global private-sector R&D spending (Hernández et al., 2019[35]).

The relevance of private-sector R&D for innovation depends on the local industrial structure. Three sectors account for about 75% of R&D. Information and communication technology (ICT) is by far the largest industry, especially when ICT producers and service providers are considered jointly. The other two sectors are the health industry and producers of automobile and other transport equipment.[4] For regions that are specialised in other activities, R&D investment might be a less important level than investment into other innovation assets.

Elements, such as design, marketing, process and product engineering, and organisational productivity-enhancing improvements, are also key factors for innovation, which are often overlooked by policy. The excessive policy focus on R&D as an ultimate source of growth can lead to what is referred to as the "innovation paradox", where some countries perform extremely well in R&D indicators but not so well in innovation outputs or economic growth. The absence of R&D does not imply the absence of innovation, knowledge or competitive success, evidencing the need for a model that does not rely excessively on R&D as the sole driver of innovation.

A two-way R&D growth model will be explained in this section, providing a framework for the broadening of innovation policy. The mainstream view on how innovation fuels growth is primarily dominated by transitions from basic research to applied research, from basic research to exploratory development or from applied research to exploratory development or advanced development. These are areas of commercialisation of R&D, which are most often the focus of innovation policies. This intense focus on upstream parts of the innovation chain overlooks other innovation drivers, such as production capabilities and engineering improvements (incremental innovations) and the diffusion, absorption and adaptation of knowledge. These factors are especially important for less-developed regions, where the role of embedded R&D from imports and adoption of technologies and knowledge developed in frontier regions is critical.

Innovation paradox: Innovation beyond R&D expenditures

The absence of R&D does not imply the absence of innovation activities and good economic performance, nor does R&D spending necessarily imply economic dynamism. R&D is just one resource within a variety of other sources of innovation. An example of the complex relation between R&D, innovation and growth lies in debates about “innovation paradoxes”: situations where only a paucity of innovative output resulted from significant investments in R&D (Audretsch and Lehmann, 2016[36]). Other examples of so-called paradoxes include the Norwegian puzzle of good economic performance despite low R&D spending (OECD, 2007[37]) or the Scottish conundrum, with its strong higher education research but poor R&D innovation output and absence of dynamic growth (Coad and Reid, 2012[38]). The Baltimore region in the United States had robust investments in R&D and human capital but failed to provide a catalyst for commercialisation of that new knowledge in the form of innovative activity (Feldman and Desrochers, 2003[39]). These examples suggest that the links between R&D, innovation and growth are not trivial.

An excessive focus on R&D as an indicator of innovation activity overlooks the fact that a significant number of firms can be innovative without in-house R&D investments. A large share of firms innovate by developing their process, product, organisational or marketing innovations without carrying out any R&D. This holds true even for firms introducing new-to-market technologies. In nearly half of the 32 OECD countries with available data, more than one-third of the firms that introduced a product that is new to the market report to not perform in-house R&D.[5] When looking into different sectors, Som (2012[40]) finds that 17% of firms in high-tech sectors do not perform any R&D, in comparison to 27% in medium-tech and 58% in low-tech sectors.

Innovation beyond technological invention

Even 41 years after the first publication of the seminal book “Diffusion of Innovation”, the 5th edition read: “Most of the new ideas whose diffusion has been analyzed are technological innovations, and we often use the word "innovation" and "technology" as synonyms” (Rogers, 2003[41]).

Inventors may develop extraordinary technologies but often such inventors and their regions are not the ones benefitting the most from the technologies they create. For example, in the late 1980s and early 1990s, the German Fraunhofer Institute for Integrated Circuits working with academic and other partners developed the technologies that became the audio encoding format MP3. While the institute, in partnership with a German company, developed and showcased a prototype portable MP3 player in the mid-1990s, the first commercially successful MP3 players were launched from 1998 and developed in Korea by Saehan Information Systems and in the United States by Diamond Multimedia.[6] The example is similar to the development of personal computers. Although the firm MITS, in New Mexico, invented the first personal computer, it was mostly Apple in California and IBM in New York (all US Companies) who dominated the new mass market for PCs by adopting and adapting the technology to produce a leap in buyer value. Often organisations (and policymakers) mistakenly assume that innovation requires developing breakthrough technologies. An excessive focus on technology can create incentives for technological developments that

are too ahead of their time, too complicated, too costly or lacking the complementary ecosystem needed to open up a new mass market.

Many inventions fail to create and capture new markets despite developing extremely ingenious technological breakthroughs. As noted by Dean Kamen, the inventor of the Segway personal transporter:

> *"One of the hardest truths for any technologist to hear is that success or failure in business is rarely determined by the quality of the technology (…). In fact, the annals of high-tech history contain remarkably few cases in which the most innovative technology has emerged triumphant in the marketplace" (Heilemann, 2001[42]).*

The Segway is an engineering prodigy but has very high production costs and did not convince enough people to pay its high price for a product that is hard to park, hard to transport and unclear as of where it can be used (on sidewalks or roads?) – a sign of a missing enabling ecosystem. While the Segway was expected to break even six months after its launch in 2001, the business continued losing money until it was sold in 2009 (Heilemann, 2001[42]).

The focus of a successful market-creating strategy is not only on how to lay a technology per se but rather on how to ensure that the technology creates value for users assuring commercial success. When defining innovation strategies, firms and regions need to go beyond only focusing on technology. As Kim and Mauborgne (2018[43]) explain, although the firm Ampex in the United States invented video recording technology in the 1950s, companies like JVC and Sony, both Japanese, dominated the long-profitable home video cassette recording (VCR) industry by adopting the technology and making video recorders easy enough to use and affordable for the mass of buyers. Ultimately, successful innovations convert a technological invention into commercial innovation creating value for users, and the firms and regions enabling such innovations are the ones benefitting the most.

Agile innovation and user-based innovation are examples of activities that are not technology-based (even though increasingly enabled by developments in ICT) but have the potential to create new forms of value and often disrupt mature industries. See Box 2.3 for examples of agile and user-based innovation.

Box 2.3. Beyond technology: Creating value with agile and user-based innovation

Agile innovation: Fostering innovation with a flexible working environment

Agile innovation is about creating small self-managed teams without traditional managers, empowering employees to make decisions and implement new ideas. These small, entrepreneurial groups are designed to stay close to customers and adapt quickly to changing conditions. When implemented correctly, they almost always result in higher team productivity and morale, faster time to market, better quality and lower risk than traditional approaches can achieve (Rigby, Sutherland and Noble, 2018[44]).

Agile teams are small and multidisciplinary. They place more value on adapting to change than on sticking to a plan and they hold themselves accountable for outcomes (such as growth, profitability or customer loyalty), not fixed outputs such as lines of code or number of new products. Netflix is an example of a company that was born agile and has become more so as it grew. It disrupted the market not because of developing a technological breakthrough, but because of its capacity to generate ideas and rapidly explore them, while its competitors did not have a business model capable of responding (Forbes, 2014[45]).

The agile way of working has spread from software development to organisational change – for small start-ups and even large, traditional organisations. Some established firms are transforming their heavy hierarchical structures (often with rigid procedures that restrain new ideas to be implemented), such as the large banks ING and Sberbank. According to Bart Schlatmann, former chief operating officer of ING, "[…] your direct competitor is no longer the benchmark for customer satisfaction, Amazon is. The

behaviour of clients is actually set by digital innovators" (Guadalupe, 2018[46]; INSEAD, 2017[47]). Firms in mature industries are becoming increasingly aware that competition is coming from unexpected small digital start-ups, offering innovative solutions and rapidly adjusting to consumer demand due to their flexible structures.

User-based innovation: Creating value along with users

Most consumer goods innovations tend to fail but a very small percentage of new product launches end up expanding and completely revolutionising their categories, driving growth for the whole industry (Schneider and Hall, 2011[48]). Affinnova (acquired by Nielsen in 2014) helps innovators select the product features that increase the likelihood of commercial success through mathematical choice modelling enabled by user-based innovation.

When Carlsberg breweries wanted to update the bottle and label for Belgium's Grimbergen, the oldest continually produced abbey beer, the company wanted to update the brand without sacrificing its strong reputation or downplaying its 900 years of history. As explained in Brynjolfsson and McAfee (2014[49]), redesigning would mean generating many candidates for each of several attributes (e.g. bottle shape, embossments, label colour, label placement, cap design and so on) and then determining the right combination of all of these.

Defining the right combination from among the thousands of possibilities is a complex task. The standard approach in the industry is for the design team to generate a few combinations that they think are good, then use focus groups or other small-scale methods to define the best.

Affinnova offers a very different approach. It makes use of the mathematics of choice modelling, quickly identifying people's preferences, by repeatedly presenting them with a small set of options and asking them to select which they like best. Affinnova presents these options via the Web and can find the mathematically optimal set of options (or at least come close to it) after involving only a few hundred people in the evaluation process (Brynjolfsson and McAfee, 2014[49]). For Grimbergen, the design that resulted from this explicitly recombinant process had an approval rating 3.5 times greater than that of the previous bottle. The strong performance resulted in solid double-digit volume growth for the Grimbergen brand (Nielsen, 2011[50]; Brynjolfsson and McAfee, 2014[49]).

Source: Rigby, D., J. Sutherland and A. Noble (2018[44]), "Agile at scale", https://hbr.org/2018/05/agile-at-scale (accessed on 10 December 2018); Forbes (2014[45]), "A look back at why Blockbuster really failed and why it didn't have to", https://www.forbes.com/sites/gregsatell/2014/09/05/a-look-back-at-why-blockbuster-really-failed-and-why-it-didnt-have-to/#6cc0d7731d64 (accessed on 10 December 2018). Guadalupe, M. (2018[46]), "Three ways to make your organisation agile", https://knowledge.insead.edu/leadership-organisations/three-ways-to-make-your-organisation-agile-8921; INSEAD (2017[47]), "Embracing digital: ING's journey to a new way of working - ING faces digital disruption", https://cases.insead.edu/publishing/case?code=36502 (accessed on 10 December 2018); Schneider, J. and J. Hall (2011[48]), "Why most product launches fail", Harvard Business Review, https://hbr.org/2011/04/why-most-product-launches-fail (accessed on 10 December 2018); Brynjolfsson, E. and A. McAfee (2014[49]), *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W.W. Norton & Company; Nielsen (2011[50]), *Carlsberg Brewery Harnesses Design Innovation Using Nielsen*, http://innovation.nielsen.com/design-solutions/grimbergen-61HP-4991X.html? (accessed on 10 December 2018).

Aligning regional innovation with grand societal challenges

Traditional innovation policy frameworks have to be reassessed in light of the environmental and social challenges in OECD countries. A traditional innovation policy framework assumes that stimulating innovation is always positive in the long term, ignoring that innovation activities do represent a certain directionality (Schot and Steinmueller, 2018[51]). For example, despite recognising that innovation may lead to unemployment in sectors experiencing rapid technical change, the generalised view is that everyone

will benefit from new higher-quality jobs in the long term – Schumpeter's process of creative destruction. However, as Soete (2013[52]) points out, innovation may also lead to destructive creation, benefitting the few at the expense of the many, by e.g. leading to low-quality jobs. Destructive creation can also come at the expense of the environment, e.g. by being grounded on a growth model that extensively employs fossil fuels, which is resource and energy-intensive or produces a massive amount of waste.

Inequality and regional disparities may inadvertently be accentuated by traditional innovation policies. Policies that provide innovation support can entail an implicit bias against some firms or places (OECD, 2017[53]). For instance, R&D tax credits may often benefit mostly large firms already with strong R&D capacity, and public procurement requirements often tend to favour experienced incumbents instead of young firms. Policies based on excellence may also be providing opportunities mostly for individuals who are already in advantage by holding some specific skills (e.g. excellence scholarships and study grants). In terms of regional disparities, successfully expanding the knowledge frontier may require funnelling public financing to the existing top universities and laboratories located in frontier regions.

The ambition to achieve a particular type of economic growth (e.g. smart, inclusive, sustainable, etc.) embraces the idea that economic growth has not only a rate but also a direction. Innovation and the current growth models may be having negative impacts in terms of job destruction and environmental degradation – elements with important local dimensions. In this context, regional innovation policy can be a key pillar to achieve transformational change by creating the incentives to align regional innovation efforts to tackle grand societal challenges such as inequality, poverty or climate change.

Mission-oriented innovation policy aligns well with such concrete challenges. Mission-oriented innovation policy is (ideally) characterised by a bold and relevant core mission that requires activity across different disciplines, economic sectors and involves different actors of the innovation system. The mission statement itself can be key to ensuring that innovation in line with the mission is activated across sectors, actors, disciplines and regions. Successful mission-oriented innovation policy must also acknowledge that there might not be a single best path or solution but enable bottom-up solutions and experimentation, i.e. link with the systemic elements of innovation policy (Mazzucato, 2018[54]).

Some of the grand challenges, such as climate change, might require more than a shared mission, rather a transformation of the economic system. Innovation policy can be a major instrument to achieve this goal. Establishing a fair price for natural capital, e.g. using carbon taxes, can induce innovation to reduce emission (Hepburn, Pless and Popp, 2018[55]). Similarly, as environmental norms and regulation may stimulate innovation, procurement is a key tool of niche creation to help firms develop technologies and attenuate the upfront costs in the early development of products. Green public procurement – a tool that 84% of OECD countries use – can, for example, incentivise the purchase of reused or recyclable electronics or office furniture products and thereby develop recycling streams.[7] Lastly, feed-in tariffs create incentives for firms to find efficient solutions to cover not only their own energy needs but also solves the challenge of aligning firms' own demand with the time in which they can produce their own supply (Koutroumpis and Lafond, 2018[15]).

Transformative innovation policy (or "system innovation") is a new innovation framework focusing on mobilising the power of innovation to address a wide range of societal challenges including climate change. It emphasises policies for directing socio-technical systems into socially desirable directions and embeds processes of change in society. The transformative innovation policy framework explores issues around socio-technical system change. The framework aims at: modifying governance arrangements between the state, the market, civil society and science; experimentation and societal learning; responsible research and innovation; and, finally, a more constructive role for foresight to shape innovation processes from the outset and on a continuing basis (Schot and Steinmueller, 2018[51]).

Regional innovation, job creation and job destruction

Innovation can displace jobs in the short-term, e.g. as investment into new production tools replaces manual labour. It also creates new jobs, but job creation can take longer to become reality and can take place in different regions from where jobs were initially displaced. This spatial friction can contribute to accentuate differences between non-frontier regions, where jobs are displaced due to disruptive innovations, and frontier regions, where the new jobs are created. The dilemma faced by policymakers is that fully enabling disruptive innovations can displace the current stock of jobs but enable the creation of new jobs in the future while restricting disruptive innovations to protect the current stock of jobs that can adversely affect regions' capacity to create jobs in the future.

Firms introduce process and product innovations in the hope that they will eventually enhance profits, whether by being able to sell more or by reducing the costs of current production (or a combination of both). The distinction between process and product innovations, formalised in OECD/Eurostat (2018[19]), picks up a fundamental distinction of innovative activities. Sometimes firms want to reduce cost with process innovation by altering their processes of production and sometimes want to enhance demand with product innovation by developing new products and/or improving their current ones. While process innovation tends to focus on efficiency gains, it does not automatically imply a reduction in the number of jobs used in the production process (Box 2.4).

Box 2.4. Process innovation, job creation and job destruction

The impact of process innovation on job displacement depends on the balance between how many jobs are cut due to productivity improvements and how many jobs are created due to increasing production responding to higher demand as prices drop.

By pursuing process innovation, firms aim at boosting productivity by decreasing costs, which can include reducing the required number of workers to produce a given output. Thus, productivity improvement through labour-saving innovation displaces jobs. The overall effect is less clear cut. As process innovation cuts costs that firms can translate into lower prices for their product, demand should increase. In order to meet such an increase in demand, firms increase production; hence, through that channel, firms create more jobs. The result in terms of net job creation or destruction will depend on how demand responds to price changes, i.e. on the elasticity of demand. Using firm-level data from France, Germany, Spain and the United Kingdom for 1998-2000 totalling about 20 000 companies, Harrison et al. (2014[56]) find that the effect of increased demand more than compensated the effect of cost reduction, leading to a positive net impact on employment.

This, of course, is not always the case and depends on the specific industry, production processes and demand. Crucially, the aggregate gain in the number of jobs might not be spatially neutral, e.g. as a more efficient plant is opened in another city or region, the local economy can be severely adversely affected.

Source: Harrison, R. et al. (2014[56]), "Does innovation stimulate employment? A firm-level analysis using comparable micro-data from four European countries", http://dx.doi.org/10.1016/j.ijindorg.2014.06.001.

Empirical evidence shows that innovation creates more jobs than it destroys. Harrison et al. (2014[56]) provide strong evidence that innovation stimulates employment both in the manufacturing and service sectors. However, there is still a doubt as to whether these employment creation results are idiosyncratic to the analysed period (1998-2000), whether disruptive innovations such as artificial intelligence (AI) can have a radically different impact and whether the dynamics of job creation are spatially uneven.

Innovation may have a net positive impact on job creation but job displacement is taking place mostly in regions behind the frontier, while job creation is benefitting mostly frontier regions. The resulting gap is of policy concern, as populations from non-frontier regions can be severely affected. This is likely to be the case with disruptive innovations related to AI drawing heavily on high availability of human capital, which is concentrated in frontier regions.

Regions with high levels of human capital are less affected by automation. With some exceptions, the risk of automation decreases as educational attainment required for the job increases. Around one-third of tertiary-educated workers are concentrated in the top 20% of OECD regions (Maguire and Weber, 2017[57]). The top regions that have a highly educated workforce have a low share of jobs at risk of automation, while the remaining regions face considerable threats. The OECD (2018[1]) presents evidence of a negative relationship between the risk of automation and the share of workers with tertiary education. Reducing the risk of automation in regions with a higher risk of automation will therefore require efforts in upgrading skills through training and education. The required skills for the industrial transformation are analysed in Chapter 3.

Policy responses need to be designed in a flexible manner to create bottom-up innovation. Flexibility in the management of national policies can provide local actors, such as local employment services, vocation education and training organisations, as well as city and regional authorities, with the necessary tools to tailor programmes to their unique local labour market challenges (OECD, 2018[1]). Flexibility encompasses the ability to make changes to national programme eligibility criteria, budget management, as well as accountability provisions. In general, awarding greater flexibility to local and regional stakeholders must be accompanied by guarantees regarding the accountability of decision-making and the efficiency of service delivery at the national level. In many cases, cities and regions can be viewed as “policy spaces” to test new ways of working and innovation approaches to address ongoing labour market changes resulting from automation.

Providing displaced workers with a social safety net, as disruptive technologies automate their jobs, can ensure they and their families do not fall into poverty. Social policies should be preventive, taking into account ongoing disruption trends and the likely risk of job destruction in different regional sectors. Preventive policies call for better co-ordination between innovation, training and social policies. Examples of preventive action include providing workers with adequate information, counselling and re-employment support ahead of their potential displacement during the notice period prior to a mass redundancy (OECD, 2018[58]).

Safety nets need to be combined with measures that ensure a rapid transition towards new opportunities. Such measures should target both the supply side and the demand side of local labour markets. On the supply side, anticipatory efforts at the local or regional levels help identify the gaps in the local skill base. Leadership can lie in the public, private or even non-profit sector, but necessarily needs to draw on the knowledge embedded in the network of firms in the region. For example, through upgrading an industrial district centre that has a high level of sophistication in product inspecting, testing and process certification, to also provide training for upskilling of the local workforce (Potter, Proto and Marchese, 2010[59]).

Demand-side measures help transition or rebuild the regional economic fabric. Importantly such measures need to go beyond supporting existing firms (and their efforts to transition) and focus also on firms trying to exploit new opportunities (start-ups, scale-ups, etc.). The challenge is how policy can develop the ability of regional institutions to absorb new technologies and pass those innovations through to existing and emerging networks of firms. An approach is to develop technology infrastructure in different places, i.e. provide infrastructure investments or capacity-building investments in research universities or co-operative research centres to bridge the gap between research and commercialisation of research in firms. Although the approach is necessarily competitive and thus risks reinforcing existing inequalities, examples such as the German Fraunhofer Institutes show that the approach can allow for many sites of

investment, with varied and specific portfolios based upon the embedded capacities of firms and institutions in an existing region (Clark, 2018[16]).

Using new digital technologies and statistical profiling techniques can improve the provision of tailored support based on workers' characteristics, increasing the effectiveness of preventive social policies. Overall, the provision of welfare benefits should be designed to maximise the chance of re-employment and minimise disincentives to work, including in the difficult case of mid-career workers who are displaced by structural economic change and need to switch industry or occupation (OECD, 2017[60]). As highlighted by the OECD (2015[61]), an effective framework for social safety net policies should: i) motivate job seekers to actively pursue employment; ii) improve their employability; and iii) expand the set of opportunities for them to be placed and retained in appropriate jobs.

"Smart Specialisation" strategies may be a useful policy instrument for concentrating local development activities in areas where there is a critical mass of knowledge and innovation potential (OECD, 2018[1]). In Slovenia, the Smart Specialisation Strategy has been focused on creating "factories of the future" through investments to raise the level of automation and robotics within the manufacturing sector (Slovenia Government Office for EU Cohesion Policy, 2015[62]).

Benefits from reshoring for mature industrial regions

A flurry of recent academic studies has highlighted the pressure that globalisation of production has put on regional labour markets. Local labour markets, identified by commuting patterns in the United States where manufacturers of goods that were directly competing with Chinese imports were located, experienced an increase in unemployment, lower labour force participation and a decline in wages. At the same time, benefit payments for unemployment, disability, retirement and healthcare rose sharply (Autor, Dorn and Hanson, 2013[63]). This impact had lasting effects on the local labour markets. Even a decade after the initial shock, wages and unemployment remain adversely affected (Autor, Dorn and Hanson, 2016[64]). The United States is not alone in the struggles of manufacturing sectors that experienced an adverse shock from increased import competition. Similar patterns are evident in small (TL3) German regions,[8] Norwegian local labour markets and Spanish provinces.

Institutional and sectoral differences across OECD countries do, however, highlight that globalisation can create new opportunities and adverse shocks can be buffered. For Norway, import competition from China led to a rise in unemployment among low-skilled workers but not among those with a college degree and wages do not seem to be adversely affected, which could be attributed to the Nordic labour market model with flexibility at the employment margin but less flexibility in adjusting wages (Balsvik, Jensen and Salvanes, 2015[65]). In Spain, the decline in manufacturing employment was compensated by an increase in non-manufacturing employment (Donoso, Martín and Minondo, 2015[66]).

The case of German manufacturing is particularly telling. The import competition from China was less important than the rise of Manufacturing in East European countries. As was the case in other countries, the shift of production towards (in this case) the east of Europe caused substantial job losses in German regions that were specialised in competing industries. These losses were not limited to manufacturing employment alone but affected employment in other sectors as well. At the same time, manufacturing industries that were export-oriented experienced a boom. They were able to utilise the opportunities created by having access to cheaper inputs and created a large number of new jobs. Estimates suggest that these gains exceeded the losses in import-competing sectors by as much as 442 000 jobs (Dauth, Findeisen and Suedekum, 2014[67]).

Policymakers in many regions express the hope that "reshoring" the activities that moved abroad will reinvigorate the industrial strengths of the past. For example, in the United States, General Electric moved the manufacturing of washing machines, fridges and heaters back from China to a factory in Kentucky. Whirlpool moved its mixer-making back from China to Ohio, and Otis moved its elevator production back

from Mexico to South Carolina (Mcgee, 2015[68]). Examples in Europe include companies such as Burberry that moved back production facilities from China to Leeds (United Kingdom), Safran moving back maintenance activities from Singapore to Saint-Amand-les-Eaux (France) or Sonae MC that moved production from China back to Portugal.[9]

Multinational enterprises (MNEs) can find it increasingly beneficial to move manufacturing activities from emerging countries to regions in developed economies. Reshoring allows firms to keep manufacturing closer to other business activities, such as R&D, design and sales, which tend to be in developed countries. Reducing distances between different business activities is increasingly important to speed up innovation processes. Firm performance is increasingly dependent on the speed of innovation and innovation today requires increasingly closer interaction between inventors, designers and manufacturers. For example, creating new products through R&D activities is more efficient if in direct contact with manufacturing to anticipate possible challenges concerning production capabilities for new products (Bailey and De Propris, 2014[69]).

The benefit of collocating activities raises two important caveats in the hope of creating development and innovation through reshoring. The first is that regions and cities with a strong economic base and internationalised firms will be more likely to see an increase in activity (or if not those places themselves than those who are close to them). The second is that the kind of jobs that are created in reshored plants are likely very different from those that were "lost" previously. To compensate for higher labour costs, labour productivity needs to be higher, which in turn means more skill- and capital-intensive production. In both cases, the benefits traditionally associated with manufacturing, in particular its provision of large numbers of medium- and low-skilled jobs at relatively high wages and its support of economic activity in regions that compete on cost advantage rather than productivity advantage, are unlikely to materialise. The potential of reshoring to support a reduction in interregional (as well as within regional) inequality might therefore be limited.

Innovation policies for regional inclusive growth

Economic growth is necessary but not sufficient for sustained and broad community revitalisation. Traditional indicators of growth, such as population, employment and income per capita, often fail to translate into improved opportunities for populations traditionally marginalised from the mainstream economy (Longworth, 2017[70]). Promoting inclusive growth requires taking an integrative approach to policy (see Box 2.5). Disruptive innovations can affect people at the bottom end of the income distribution the most. In places with little or no economic growth, adjusting to the impact of automation on social inclusion is extremely challenging. In regions experiencing higher growth rates, a tight labour market is an opportunity to bring marginalised populations into the labour force.

Box 2.5. An integrative approach for economic inclusion in the Midwest, Unites States

Longworth, George and O'Dell (2019[71]) examine cities in the Midwest of the United States – a region which experienced significant manufacturing job losses and has highly pronounced racial and ethnic disparities in terms of income, poverty rates, unemployment, educational attainment or homeownership for example. Fragmentation and misalignment are the factors perpetuating inequalities. At a geographic level, overlapping units of government such as school district boundaries conflicting with municipal boundaries result in disparate outcomes. A large number of social programmes are in place but often working in silos and with no evidence of impact.

Economic exclusion manifests itself in disparities – most commonly along racial lines. Other factors include age, faith, immigration status and disability. Indicators that can provide measures of exclusion include, for example, educational attainment, income, homeownership and employment. Economic

conditions for white people are consistently better: unemployment and poverty rates are lower and incomes are higher, as are homeownership rates and educational attainment levels. As general points, Longworth, George and O'Dell (2019[71]) conclude that:

- Economic growth is a necessary but not sufficient condition to foster economic inclusion.
- Economic inclusion is not about redistributing the benefits of economic growth; it is, instead, an ingredient of a more durable strategy for growth.
- Economic inclusion requires economic development strategies that break down barriers and deliver opportunities to underserved populations, placing responsibility on places and institutions rather than individuals.

Economic inclusion has become an aspirational imperative for cities, especially those that have diligently pursued strategies of economic growth only to find that economic well-being did not improve for all residents. Growth alone does not address the underlying challenges of equity and opportunity. Promoting inclusion requires polices at the local level addressing issues such as availability of public transportation, childcare, early career development or information about opportunities, and anticipating barriers (e.g. affordable housing where new firms are developing). Additionally, local public programmes need more impact measurement and to focus on outputs, for example, not only having success indicators measuring how many people have access to a given programme, for instance, but how much people actually benefit from it.

Source: Longworth, S., T. George and M. O'Dell (2019[71]), "Preliminary findings from focus groups on economic inclusion in smaller cities", *ProfitWise News and Views*, No. 2, Federal Reserve Bank of Chicago.

Innovation policies may be used to foster inclusiveness, for example, if they lead to the development of affordable goods and services tailored to the needs of the people who have been "left behind". Inclusive innovation policies aim at promoting inclusive growth and remove barriers to the participation of individuals, social groups, firms, sectors and regions that are underrepresented in innovation activities (OECD, 2017[53]). Their objective is to provide all segments of society with equal opportunities to successfully participate in and benefit from innovation, and ultimately to benefit from the forces of globalisation and technological change.

The instruments used in inclusive innovation policies are not new, mostly consisting of adaptations of traditional instruments. They include well-known traditional innovation policy instruments such as grants to fund research projects, innovation vouchers and entrepreneurship education schemes (OECD, 2017[53]). The difference consists in the new objective for which they are conceived and new directionality they aim to give innovation activities. Inclusive innovation policy instruments are designed to facilitate the participation in research, innovation and entrepreneurial activities of those groups that currently have fewer capacities or opportunities to do so.

Table 2.1 summarises the three types of inclusiveness (social inclusiveness, industrial inclusiveness and regional inclusiveness) and provides definitions and examples for each type of policy. These efforts might be perceived as foregoing efficiency considerations, i.e. it might be argued that public support should focus on top firms or frontier regions rather than on "laggards". This does not need to be the case, the returns from investment in laggards have greater growth potential through an "advantage of backwardness" (OECD, 2016[4]), investment can also lead to a different development path and endogenous accumulation of further investment (Rodríguez-Pose, 2005[72]). To unlock the benefits of investment, policy often has to address additional barriers (see Chapter 4).

Table 2.1. Innovation policies for inclusiveness

	Definition	Examples
Social inclusiveness	Policies broadening the group of innovators by including underrepresented individuals and groups in research, entrepreneurship and innovation activities. These policies can either build innovation capabilities of disadvantaged groups or facilitate their access to opportunities to participate in innovative activities.	In Israel, the Support Programmes for Companies from the Ultra-Orthodox and Arab Minority Communities, incentivise companies that have at least 33% of their share capital held by an entrepreneur of a minority group or from the ultra-Orthodox community to engage in product development projects by providing grants covering 85% of the project's budget.
Industrial inclusiveness	Policies aiming to support innovation activities in less innovative firms (including micro-entrepreneurs, SMEs and start-ups) and traditional sectors. The focus is on strengthening their innovation capacities, as well as on building an adequate business environment for innovation.	In the People's Republic of China, the Innovation Fund for SMEs provides both financial and professional advisory support for SMEs that aims at engaging in innovative activities. Professional business counselling or advice to entrepreneurs is frequently part of broader support schemes and a condition for receiving financial support. Similarly, in Israel, the programme for encouraging R&D in traditional industries provides professional counselling in addition to grants to those firms in such industries that decide to engage in an R&D project.
Territorial inclusiveness	Policies targeting lagging and less innovative regions to narrow the performance gap with leading innovation regions. They foster the innovation capacity of individuals and firms located in peripheral regions, as well as in disadvantaged neighbourhoods within large urban areas.	In Korea, technology parks have been built to address the gap between the metropolitan area of Seoul and other more peripheral regions. Technology park development includes the construction of infrastructure (e.g. common business support facilities, incubators), locating of research centres and universities to increase the pool of human capital and promote R&D, implementation of networking programmes and incentives for joint R&D projects, and the provision of finance for tech-based SMEs and start-ups, including through venture and seed capital.

Source: Adapted from OECD (2017[53]), *Making Innovation Benefit All: Policies for Inclusive Growth*, https://www.oecd.org/innovation/inno/making-innovation-benefit-all.pdf.

Innovation policies for regional sustainable growth

Innovation policies have directed innovation activities towards a growth model based on a production and consumption framework that is unsustainable. Most traditional innovation policies have been based on a 20th-century supply-driven innovation model, which takes competition between nations and support for R&D as the main entry point for policymaking (Schot and Steinmueller, 2018[51]). The current innovation framework has directed a growth path that seems unable to address the key environmental challenges we are facing, including, for example, the climate change effects of greenhouse gas emissions or the environmental effects of household and industrial waste.

The impact of the current model on climate change has strong local dimensions. For example, sea-level rise will disproportionally affect coastal areas, with average global flood losses estimated at approximately USD 6 billion per year in 2005 (OECD, 2019[3]). By 2050, these losses may potentially increase to USD 52 billion in 136 of the world's largest coastal cities, even in the absence of climate change, as projected socio-economic change (i.e. growing populations and assets) alone will lead to heightened vulnerability (Hallegatte et al., 2013[73]).

Mission-oriented policies are a potential form of applying the transformative innovation policy framework in regional innovation policymaking. Mission-oriented innovation policies aim at influencing the direction of innovation activity towards a particular type of growth model. The active role being taken by the public sector towards renewable energy investments can be seen as a new mission in relation to the green economy to promote sustainable growth. Defining a mission requires addressing a challenge instead of

focusing on the development of particular technologies (Mazzucato, 2018[74]), a "challenge" being an area identified as a priority (whether through political leadership, or the outcome of a movement in civil society). As an example of a tool to jointly and dynamically address the issue of identifying a common challenge, the EU's Smart Specialisation relies on an embedded entrepreneurial discovery process.

An example of a mission-oriented programme with important local dimensions is the Viable Cities programme in Sweden. The programme has the mission of fostering the transition to resource-efficient and fossil-free liveable smart cities in Sweden, bringing together around 50 stakeholders in various areas of research, industry, civil society and local authorities. The programme provides grants for pre-studies, research, innovation or demonstration projects for smart and sustainable cities (Viable Cities, 2018[75]). Moreover, it promotes collaborative partnerships, requiring applicants to form groups of least three independent actors, where at least two have to be from a different nature (among universities, business, local public sector organisations or non-profit organisations).

The Yokohama Smart City Project is an additional example of a mission-oriented programme in Japan, aiming to improve energy efficiency and mitigate climate change. The city of Yokohama introduced a Community Energy Management System to achieve efficient energy management by linking individual management systems (e.g. in homes, office buildings and factories) to stationary energy storage (OECD, 2019[3]). Specific achievements of the programme include, for instance, the installation of emergency management systems in 4 200 homes, the introduction of 2 300 electric vehicles and of 37 MW of photovoltaic generation, and the reduction of 39 000 tonnes of CO_2 emissions (IEA, 2016[76]).

Going beyond best practices to best matches: One size does not fit all

The mainstream view of traditional innovation policy is that upgrading of innovation processes follows an increased intensity in R&D. The linear R&D growth model consists of upward transitions from basic research to applied research, from basic research to exploratory development or from applied research to exploratory development or advanced development. These are upstream areas of the innovation value chain related to the "commercialisation of R&D", which are the core focus of traditional innovation policies. However, productivity depends not only on upstream R&D activities but also on absorptive capacity, diffusion and demand. The linear R&D model ignores the distinction between production capability and technology capability and ignores production capability and other downstream innovation activities as key sources of innovation and productivity growth.

Innovation policy needs to reflect heterogeneity in terms of innovation capacity within and across regions. However, the opposite is often the case. Highly heterogeneous regions or even countries are setting homogeneous policy mixes, not adapting to different local capacities and opportunities. This is unproductive because copying ready-made policy solutions that worked elsewhere and that do not adapt to regional contexts will likely fail to produce positive results. Learning from other regions' experiences is a fruitful policy exercise but requires identifying best matches instead of copying ready-made policies considered as best practices. Identifying successful policy cases in regions that share similar characteristics and innovation drivers is the first step, but successful policies need to be adapted to the region's own context. Chapter 4 discusses this point with a view of regions that are lagging behind the innovation frontier. For these regions, a linear view of technological upgrading is often misguided as different ways can improve the technological capabilities of a region.

Downstream areas of the innovation value chain are critical for productivity given their weight on absorptive capacity, innovation diffusion and demand. Many innovative activities are based on finding new uses or diffusion of existing knowledge and are not covered by the definition of R&D. For example, through technological adoption, the R&D embedded in purchased manufacturing equipment can give access to all the embedded knowledge that was necessary to produce it but is not considered as R&D investment, so is not of key importance in traditional innovation policies. Likewise, innovation requires operating or

production capabilities and design, engineering and associated management capabilities but these are usually out of the scope of innovation statistical surveys (Bell, 2007[77]). The inclusion of non-R&D business innovation expenditures in surveys such as the Regional Innovation Scoreboard (RIS) of the EC is a good move towards identifying and measuring such types of innovation activities (EC, 2017[78]).

Innovation policy in Poland can be used to illustrate different elements of the non-linear growth model across different EU programming periods. During the 2007-13 programming period, Poland focused on the adoption of technologies developed elsewhere, exploring embedded R&D. That policy favoured technology adoption and use, typically confining programmes to the purchase of the latest equipment and machinery. The 2014-20 programming period saw a break in the approach and an "innovation tsunami", focused narrowly on early-stage risk capital and R&D expenditures (Breznitz and Ornston, 2017[79]). While this represented a strong shift from technology adoption towards own R&D efforts, the critical challenge of innovation policy should be combining or coupling the two types of innovation efforts. The challenge for 2020-27 will be coupling investments in business R&D with significant investments in human capital (both university and vocational education) and technology upgrading or investments in activities such as design, engineering, production capabilities and management practices that are conducive to innovation (Radošević, 2018[9]).

Heterogeneous regional contexts with homogeneous policy mixes

Regional innovation policies remained fairly homogeneous with low levels of experimentation and adaptation to regional idiosyncrasies. Izsak, Markianidou and Radošević (2014[80]) identified a set of five policy approaches widely used in most EU countries, pointing at an unexpected convergence and very slow evolution among innovation policy mixes. Veugelers and Schweiger (2015[81]) reach the same conclusion by focusing on countries from Central Asia and Eastern Europe. They note that innovation policies "are surprisingly similar, characterised by an excessive focus on the creation of technology, particularly from public-funded research organisations and insufficient attention to the absorption of technology by the private sector". Most of the available assessments are based on innovation policies for the prior programming period, as Smart Specialisation Strategies (and its underlying entrepreneurial discovery processes) have further matured over the 2014-20 period and more regions have likely embraced experimentation.

Regions are following similar solutions to solve different problems and with different capacities to implement such solutions. Policy-specific evaluations confirm that innovation policy measures that work in some frameworks are inappropriate in others. For example, evaluations of the effectiveness of innovation tax incentives policies show that very similar measures can have extremely differentiated impacts (Mohnen, Vankan and Verspagen, 2017[82]).

Learning what best practices make policies work is important; however, best practices can be region-specific. Their underlying success factors can be conditional on regional characteristics. Identifying best practices is a necessary but not sufficient condition. Finding the best matches for best practices can enable learning from other policy experiences, as it requires looking at the specific regional conditions behind each practice. Policies that pass the design phase need to adjust to regional circumstances in order to successfully begin the implementation phase and ultimately stimulate regional development.

Implementing best matches requires identifying regions' innovation challenges and match the appropriate instruments to the existing capacities through a process of "entrepreneurial discovery". The entrepreneurial discovery process consists of engaging local innovation stakeholders to better understand their strengths and weaknesses. This can involve, for example, engaging the "quadruple helix" by identifying and gathering leaders from different regional stakeholders, such as local industries, academia, public authorities and non-profits, and pursue participative governance processes defining regional innovation strategies. Regional strategies for economic rejuvenation are likely to fail without support from local

innovation stakeholders. Chapter 5 provides practical examples of how to operationalise such participative governance structures for engaging multiple stakeholders.

Regional benchmarking

Regional benchmarking can be of great value for identifying best policy matches in the design and implementation processes of regional innovation policies. S3 policies present much space for improvement in enabling differentiated policy strategies based on regional assets. A tendency to mechanically imitate best practices from advanced countries or regions and maintain traditional interventions persists in S3 policy frameworks. For example, the case of "Estonia follows Finland" shows that:

> *"A number of interesting and similar issues are being experienced by Finland and Estonia in their application of smart specialisation, and indeed their trajectories are looking increasingly similar as the agenda progresses […]. The two countries are specialising in remarkably similar areas and pursuing surprisingly similar strategies in direct contrast to the central edict of the smart specialisation approach that it will reduce duplication and competition between European regions […]. The same issues and barriers may be faced by similar countries of a small, weak, and peripheral nature within the EU, and their needs and experiences could be quite different from their dominant and economically successful neighbours." (Tsipouri, 2018[10])*

An effective transfer of good policy practices and solutions between regions consists of finding the best practices that better match regional contexts. Such exercise requires a methodical comparison with peers that can help identify distinctive policy approaches that work in regions with similar characteristics. A sound exercise of regional benchmarking can thus support policymakers identify what policy practices can be transferred, followed and adapted.

The smart specialisation platform, in co-operation with Orkestra (Basque Institute of Competitiveness), jointly developed a methodology enabling to identify regions sharing similar structural conditions that are relevant for innovation-driven development. Examples of regional conditions include social, economic, technological, institutional and geographical characteristics. The tool can help other regions that share similar characteristics. The choice of characteristics is based on their relevance as innovation drivers and on being difficult to change in the short term. Examples of such characteristics include regions' institutional capacity, industrial structure, human capital and trade openness (Navarro et al., 2014[83]). The following step for this valuable tool is to provide examples of successful regional policies, enabling other regions to learn by identifying possible best policy matches.

Bridging gaps across levels of government and breaking policy silos

Implementing regional innovation policies by pursuing a best match approach requires giving a more prominent role to local governments. Since the 1970s, countries are increasingly decentralising responsibilities from the national to the regional level and there has been an increase in metropolitan governance arrangements.[10]

Cities are becoming increasingly active players in innovation policy. In a recent study, 77% of the surveyed cities indicated having dedicated funding schemes to support innovation (OECD/Bloomberg, forthcoming[84]). Most innovation efforts are tailored to improve service delivery (e.g. for emergency services, housing, mobility and social services), to improve internal government operations (e.g. streamlining budget processes and workflows and to foster inter-agency co-operation) and to improve residents' quality of life (such as health and job outcomes). Funding for cities' innovation instruments come from municipal budgets but also other sources, such as external (non-public) funding and national government budgets.

Multi-level governance in innovation policy

With decentralisation of policymaking on the rise, co-ordination across different levels of government becomes essential. The increasing decentralisation trend can facilitate policy adaptation to local contexts, but innovation policy is still dominated by national governments (Veugelers, 2015[85]), which makes co-operation between local and national governments a critical factor (see also Chapter 5).

Policy coherence across multiple levels of government has the potential to enable complementarities between instruments managed by local and national authorities. Coherence also helps to avoid potential duplications of efforts or even negative policy interactions. In some cases, the division of power between national and regional governments is clear but, in other cases, those powers are shared. For example, in most countries, national governments are responsible for intellectual property rights, while both the national and regional levels share responsibility for developing incubators and scientific parks, or funding R&D projects (OECD, 2011[31]).

Overlapping national and regional policy instruments can create synergies if both levels complement one another. Such complementariness can arise in the way the instruments are built in terms of their target actors, innovation phases or across different innovation factors. The proliferation of public support programmes at different levels can also lead to inconsistencies, bureaucratic and political conflict, lack of consensus when setting priorities and, ultimately, higher administrative costs, complexity and confusion for local actors. Examples of mechanisms to ensure efficient national-regional policy coherence include national-regional policy councils or agencies, national-regional contracts, joint funds and other more informal modes of co-ordination such as regular dialogue and consultation process (OECD, 2011[31]).

Policy co-ordination beyond silos

Policy success in a given region can be determined by the existence of other policies that address complementary sectors or agents. Copying a successful policy implemented elsewhere can still fail if important complementary policies are not in place, or if existing regional policies are in conflict with the policy being implemented. As innovation becomes ever more multidisciplinary and complex, breaking silos across policy areas becomes a priority in order to implement best matches.

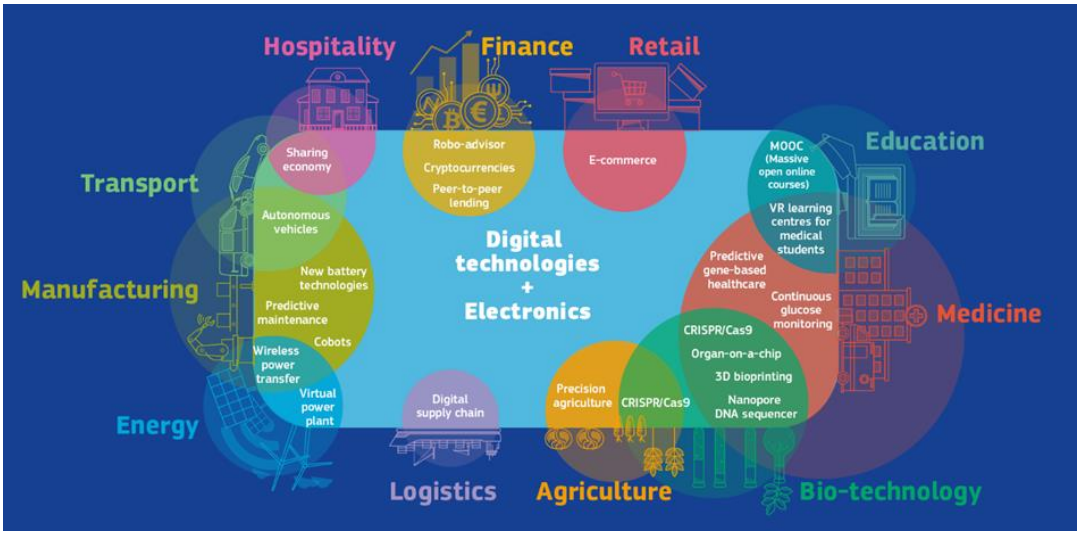
Innovation activities are taking place in the fringes of different business, technological and scientific sectors, and involving interactions across multiple actors in several stages of the innovation value chain. Disruptive changes are happening in the interaction of multiple sectors, e.g. of biotech and medicine, such as CRISPR, or at the intersection of transport and manufacturing, as autonomous vehicles (see Figure 2.2). Innovation is becoming increasingly complex as digital technologies are integrating with analogue technologies. For firms, this means that they need to combine different advanced technologies and implement new business models to take advantage of innovation. “Off the shelf” technologies become less powerful. The commercialisation of these innovations often involves collaborations between university scientists, entrepreneurs and large firms.

Policies targeting individual sectors with no coherence with other regional or national policies targeting complementary sectors will fail to support the innovation of multidisciplinary nature. An example concerning the importance of policy complementarities is the case of innovation grants. Innovation grants are often implemented by local governments but have been found to be rather ineffective when attention is not paid to the context set by other policies, targeting education, labour market, competition and macroeconomic stabilisation for example (Aghion, David and Foray, 2009[86]). The example shows that identifying best matches requires taking into account the necessary coherence across multiple policy areas in addition to coherence across different layers of government.

Breaking policy silos to enable an integrative approach, whereby several factors for growth are targeted simultaneously, pays off. For example, infrastructure improvements can have a positive impact when other factors are also present in a region, such as strong human capital, robust employment rates and good

entrepreneurship rates (Box 2.6). Creating regional bodies concentrating different innovation policy responsibilities or that oversee and co-ordinate different policy agents present in the region are examples of efforts to build policy coherence.

Figure 2.2. The convergence between the physical, digital and biological worlds



Source: EC (2020[87]), *Science, Research and Innovation Performance of the EU 2020: A Fair, Green and Digital Europe*, Directorate-General for Research and Innovation, European Commission.

Box 2.6. Pursuing an integrated approach to enable policy complementarities

OECD analysis of the determinants of growth at the regional level identifies a number of critical drivers, including infrastructure, human capital, innovation and agglomeration (OECD, 2009[88]). Importantly, these factors: i) are largely endogenous, i.e. they can be addressed by policy (as opposed to natural endowments or physical geography); and ii) complement each other, suggesting the need for an integrated approach. Relevant determinants fall under the responsibility of different policy areas across different levels of government, requiring efforts to ensure policy co-ordination.

- Improvements in infrastructure at the regional level do not automatically lead to higher growth. Such investments need to be combined with improvements in education and innovation. This suggests it is useful to co-ordinate policies for building human capital, enhancing innovation and providing physical infrastructure. The effects of infrastructure investment appear to last around 3-5 years.
- Human capital – both the presence of high-skilled workers in the regional workforce and the absence of low-skilled workers – appears to be the most robust supporter of growth in all types of regions. The effects of improvements in human capital also appear to last around five years.
- The third critical element is innovation (measured in terms of its science and technology components). Innovation appears to produce positive effects over a longer time span of approximately ten years.
- Economies of agglomeration also have a positive impact on growth, although they are neither necessary nor sufficient to ensure sustained growth rates.

Source: OECD (2009[88]), *How Regions Grow: Trends and Analysis*, https://dx.doi.org/10.1787/9789264039469-en.

References

Aghion, P., P. David and D. Foray (2009), "Science, technology and innovation for economic growth: Linking policy research and practice in 'STIG Systems'", *Research Policy*, Vol. 38/4, pp. 681-693, http://dx.doi.org/10.1016/j.respol.2009.01.016. [86]

Audretsch, D. (2018), "Developing strategies for industrial transition", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 15 October 2018, Paris. [13]

Audretsch, D. and E. Lehmann (2016), *The Seven Secrets of Germany*, Oxford University Press, http://dx.doi.org/10.1093/acprof:oso/9780190258696.001.0001. [36]

Autor, D., D. Dorn and G. Hanson (2016), "The China shock: Learning from labor-market adjustment to large changes in trade", *Annual Review of Economics*, Vol. 8, pp. 205-240. [64]

Autor, D., D. Dorn and G. Hanson (2013), "The China syndrome: Local labor market effects of import competition in the United States", *American Economic Review*, Vol. 103/6, pp. 2121-2168. [63]

Bailey, D. and L. De Propris (2014), "Manufacturing reshoring and its limits: The UK automotive case", *Cambridge Journal of Regions, Economy and Society*, Vol. 7/3, pp. 379-395, http://dx.doi.org/10.1093/cjres/rsu019. [69]

Balsvik, R., S. Jensen and K. Salvanes (2015), "Made in China, sold in Norway: Local labor market effects of an import shock", *Journal of Public Economics*, Vol. 127, pp. 137-144. [65]

BEIS (2017), *Industrial Strategy: Building a Britain Fit for the Future*, Department for Business, Energy & Industrial Strategy. [21]

Bell, M. (2007), "Technological learning and the development of productive and innovative capacities in the industry and infrastructure sectors of the least developed countries: What's roles for ODA?", *The Least Developed Countries Report 2007*, Background Paper No. 10, UNCTAD, https://unctad.org/Sections/ldc_dir/docs/ldcr2007_Bell_en.pdf (accessed on 10 January 2019). [77]

Bianchini, M. and V. Michalkova (2019), "Data Analytics in SMEs: Trends and Policies", *OECD SME and Entrepreneurship Papers*, No. 15, OECD Publishing, Paris, https://dx.doi.org/10.1787/1de6c6a7-en. [92]

Bloom, N. et al. (2017), "Are ideas getting harder to find?", National Bureau of Economic Research, Cambridge, MA, http://dx.doi.org/10.3386/w23782. [5]

Breznitz, D. and D. Ornston (2017), "EU financing and innovation in Poland", *SSRN Electronic Journal*, http://dx.doi.org/10.2139/ssrn.3119663. [79]

Brynjolfsson, E. and A. McAfee (2014), *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W.W. Norton & Company. [49]

Cirera, X. and W. Maloney (2017), *The Innovation Paradox: Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up*, World Bank, Washington, DC, https://openknowledge.worldbank.org/handle/10986/28341. [30]

Clark, J. (2018), "Managing disruptive technologies", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 22 November 2018, Paris. [16]

Coad, A. and A. Reid (2012), *The Role of Technology and Technology-based Firms in Economic Development: Rethinking Innovation and Enterprise Policy in Scotland*, Technopolis group, Brussels, http://www.evaluationsonline.org.uk/evaluations/Browse.do?ui=browse&action=show&id=504&taxonomy=INO (accessed on 10 January 2019). [38]

Crescenzi, R. and O. Harman (2018), "Building, embedding and reshaping GVCs and the associated role of global investment flows", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 21 September 2018, Paris. [11]

Dauth, W., S. Findeisen and J. Suedekum (2014), "The rise of the east and the far east: German labor markets and trade integration", *Journal of the European Economic Association*, Vol. 12/6, pp. 1643-1675. [67]

Donoso, V., V. Martín and A. Minondo (2015), "Do differences in the exposure to Chinese imports lead to differences in local labour market outcomes? An analysis for Spanish provinces", *Regional Studies*, Vol. 49/10, pp. 1746-1764. [66]

EC (2020), *Science, Research and Innovation Performance of the EU 2020: A Fair, Green and Digital Europe*, Directorate-General for Research and Innovation, European Commission. [87]

EC (2020), *What is Smart Specialisation*, European Commission, https://s3platform.jrc.ec.europa.eu/en/what-is-smart-specialisation- (accessed on 30 June 2020). [34]

EC (2017), *Regional Innovation Scoreboard*, European Commission, http://ec.europa.eu/growth/industry/innovation/facts-figures/regional_en (accessed on 10 January 2019). [78]

Edler, J. and J. Fagerberg (2017), "Innovation policy: What, why, and how", *Oxford Review of Economic Policy*, Vol. 33/1, pp. 2-23. [20]

Feldman, M. and P. Desrochers (2003), "Research universities and local economic development: Lessons from the history of the Johns Hopkins University", *Industry & Innovation*, Vol. 10/1, pp. 5-24, http://dx.doi.org/10.1080/1366271032000068078. [39]

Forbes (2014), "A look back at why Blockbuster really failed and why it didn't have to", Forbes Magazine, https://www.forbes.com/sites/gregsatell/2014/09/05/a-look-back-at-why-blockbuster-really-failed-and-why-it-didnt-have-to/#6cc0d7731d64 (accessed on 10 December 2018). [45]

Freeman, C. (1987), *Technology and Economic Performance: Lessons from Japan*, Pinter. [24]

Gordon, R. (2017), "Afterword", in *The Rise and Fall of American Growth*, Paperback edition, Princeton University Press, http://economics.weinberg.northwestern.edu/robert-gordon/files/RescPapers/Afterword%20text%20with%20table_170416.pdf (accessed on 11 December 2018). [6]

Guadalupe, M. (2018), “Three ways to make your organisation agile”, INSEAD Knowledge, https://knowledge.insead.edu/leadership-organisations/three-ways-to-make-your-organisation-agile-8921 (accessed on 10 December 2018). [46]

Hallegatte, S. et al. (2013), “Future flood losses in major coastal cities”, *Nature Climate Change*, Vol. 3/9, pp. 802-806, http://dx.doi.org/10.1038/nclimate1979. [73]

Harrison, R. et al. (2014), “Does innovation stimulate employment? A firm-level analysis using comparable micro-data from four European countries”, *International Journal of Industrial Organization*, Vol. 35, pp. 29-43, http://dx.doi.org/10.1016/j.ijindorg.2014.06.001. [56]

Heilemann, J. (2001), *Reinventing the wheel*, http://content.time.com/time/business/article/0,8599,186660-3,00.html (accessed on 10 December 2018). [42]

Hepburn, C., J. Pless and D. Popp (2018), “Policy brief - Encouraging innovation that protects environmental systems: Five policy proposals”, *Review of Environmental Economics and Policy*, Vol. 12/1, pp. 154-169. [55]

Hernández, H. et al. (2019), *The 2019 EU Industrial R&D Investment Scoreboard*, Publications Office of the European Union, EUR 29450 EN, Luxembourg, JRC113807, http://dx.doi.org/10.2760/131813. [35]

IEA (2016), *Energy Technology Perspectives 2016*, OECD Publishing, Paris, http://dx.doi.org/10.1787/energy_tech-2016-en. [76]

INSEAD (2017), “Embracing digital: ING’s journey to a new way of working - ING faces digital disruption”, *INSEAD Case Studies*, https://cases.insead.edu/publishing/case?code=36502 (accessed on 10 December 2018). [47]

Isaksen, A., R. Martin and M. Trippl (2018), “New avenues for regional innovation systems and policy”, in Isaksen, A., R. Martin and M. Trippl (eds.), *New Avenues for Regional Innovation Systems - Theoretical Advances, Empirical Cases and Policy Lessons*, Springer International Publishing. [23]

Izsak, K., P. Markianidou and S. Radošević (2014), “Convergence among national innovation policy mixes in Europe – An analysis of research and innovation policy measures in the period 2004-2012”*, GRINCOH Working Paper Series*. [80]

Kim, C. and R. Mauborgne (2018), *Why tech innovation isn’t the answer everyone thinks it is*, INSEAD Knowledge, https://knowledge.insead.edu/blog/insead-blog/why-tech-innovation-isnt-the-answer-everyone-thinks-it-is-8526 (accessed on 10 December 2018). [43]

Koutroumpis, P. and F. Lafond (2018), “Disruptive technologies and regional innovation policy”, Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 22 November 2018, Paris. [15]

Labory, S. and P. Bianchi (2018), “What policies, initiatives or programmes can support attracting, embedding and reshaping GVCs in regions?”, Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 21 September 2018, Paris. [12]

Laredo, P. (2016), “Innovation policies: The national and regional dimensions”, *Economia e Politica Industriale*, Vol. 43/3, pp. 323-330. [32]

Longworth, S. (2017), "Looking for progress in America's smaller legacy cities: A report for place-based funders", *ProfitWise News and Views*, No. 3, Federal Reserve Bank of Chicago, Chicago, https://www.chicagofed.org/publications/profitwise-news-and-views/2017/looking-for-progress-in-americas-smallers-legacy-cities (accessed on 3 December 2018). [70]

Longworth, S., T. George and M. O'Dell (2019), "Preliminary findings from focus groups on economic inclusion in smaller cities", *ProfitWise News and Views*, No. 2, Federal Reserve Bank of Chicago. [71]

Lundvall, B. (ed.) (1992), *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning*, Pinter. [25]

Maguire, K. and J. Weber (2017), "Innovation and territorial inclusiveness: Recent regional trends and policy options", in *Making Innovation Benefit All: Policies for Inclusive Growth*, OECD Publishing, Paris, https://www.oecd.org/innovation/inno/making-innovation-benefit-all.pdf. [57]

Mazzucato, M. (2018), "Mission-oriented innovation policies: Challenges and opportunities", *Industrial and Corporate Change*, Vol. 27/5, pp. 803-815, http://dx.doi.org/10.1093/icc/dty034. [74]

Mazzucato, M. (2018), "Mission-oriented research & innovation in the European Union: A problem-solving approach to fuel innovation-led growth", Missions, Publications Office of the European Union, Luxembourg. [54]

Mcgee, M. (2015), "The modern day border war: How Kansas can end its economic development battle with Missouri in the Kansas City Metropolitan Area", *Kansas Journal of Law & Public Policy*, Vol. 25/1, pp. 111-130. [68]

Mohnen, P., A. Vankan and B. Verspagen (2017), "Evaluating the innovation box tax policy instrument in the Netherlands, 2007-13", *Oxford Review of Economic Policy*, Vol. 33/1, pp. 141-156, http://dx.doi.org/10.1093/oxrep/grw038. [82]

Morgan, K. (2018), "Experimental governance and territorial development", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 14 December 2018, Paris. [17]

Navarro, M. et al. (2014), "Regional benchmarking in the smart specialisation process: Identification of reference regions based on structural similarity", *S3 Working Paper Series*, No. 03/2014, Joint Research Centre of the European Commission, Seville, http://s3platform.jrc.ec.europa.eu/-/regional-benchmarking-in-the-smart-specialisation-process-identification-of-reference-regions-based-on-structural-similarity (accessed on 11 January 2019). [83]

Nelson, R. (ed.) (1993), *National Innovation Systems. A Comparative Analysis*, Oxford University Press. [26]

Nielsen (2011), *Carlsberg Brewery Harnesses Design Innovation Using Nielsen*, Nielsen Design Solutions - Carlsberger Breweries, http://innovation.nielsen.com/design-solutions/grimbergen-61HP-4991X.html? (accessed on 10 December 2018). [50]

OECD (2019), *Making Decentralisation Work: A Handbook for Policy-Makers*, OECD Multi-level Governance Studies, OECD Publishing, Paris, https://dx.doi.org/10.1787/g2g9faa7-en. [89]

OECD (2019), *OECD Regional Outlook 2019: Leveraging Megatrends for Cities and Rural Areas*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264312838-en. [3]

OECD (2019), *Regions in Industrial Transition: Policies for People and Places*, OECD Publishing, Paris, https://dx.doi.org/10.1787/c76ec2a1-en. [91]

OECD (2018), *Job Creation and Local Economic Development 2018: Preparing for the Future of Work*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264305342-en. [1]

OECD (2018), *OECD Science, Technology and Innovation Outlook 2018: Adapting to Technological and Societal Disruption*, OECD Publishing, Paris, https://dx.doi.org/10.1787/sti_in_outlook-2018-en. [7]

OECD (2018), *The Future of Social Protection: What Works for Non-standard Workers?*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264306943-en. [58]

OECD (2017), *Making Innovation Benefit All: Policies for Inclusive Growth*, OECD Publishing, Paris, https://www.oecd.org/innovation/inno/making-innovation-benefit-all.pdf. [53]

OECD (2017), *OECD Employment Outlook 2017*, OECD Publishing, Paris, https://dx.doi.org/10.1787/empl_outlook-2017-en. [60]

OECD (2017), *The Governance of Land Use in the Netherlands: The Case of Amsterdam*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264274648-en. [90]

OECD (2016), *OECD Regional Outlook 2016: Productive Regions for Inclusive Societies*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264260245-en. [4]

OECD (2015), "Activation policies for more inclusive labour markets", in *OECD Employment Outlook 2015*, OECD Publishing, Paris, https://dx.doi.org/10.1787/empl_outlook-2015-7-en. [61]

OECD (2015), *The Future of Productivity*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264248533-en. [2]

OECD (2011), *Demand-side Innovation Policies*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264098886-en. [22]

OECD (2011), *Regions and Innovation Policy*, OECD Reviews of Regional Innovation, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264097803-en. [31]

OECD (2009), *How Regions Grow: Trends and Analysis*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264039469-en. [88]

OECD (2007), *OECD Economic Surveys: Norway 2007*, OECD Publishing, Paris, https://dx.doi.org/10.1787/eco_surveys-nor-2007-en. [37]

OECD (1999), *Managing National Innovation Systems*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264189416-en. [33]

OECD (1997), *National Innovation Systems*, OECD, Paris, https://www.oecd.org/science/inno/2101733.pdf. [29]

OECD/Bloomberg (forthcoming), *Enhancing Innovation Capacity in Cities*, OECD Publishing, Paris. [84]

OECD/Eurostat (2018), *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg, https://dx.doi.org/10.1787/9789264304604-en. [19]

Patel, P. and K. Pavitt (1994), "The Nature and Economic Importance of", *STI Review, No. 14*. [27]

Potter, J., A. Proto and M. Marchese (2010), "Entrepreneurship, SMEs and Local Development in the Marche Region, Italy", *OECD Local Economic and Employment Development (LEED) Papers*, No. 2010/12, OECD Publishing, Paris, https://dx.doi.org/10.1787/5km7jf7tj6mt-en. [59]

Pyke, F. (2018), "Managing technological change for inclusive growth", *Cambridge Journal of Economics*, Vol. 42/6, pp. 1687-1695, http://dx.doi.org/10.1093/cje/bey023. [8]

Radošević, S. (2018), "Fostering innovation in less-developed and low institutional capacity regions: Challenges and opportunities", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 22 June 2018, Paris. [9]

Rigby, D., J. Sutherland and A. Noble (2018), "Agile at scale", Harvard Business Review, https://hbr.org/2018/05/agile-at-scale (accessed on 10 December 2018). [44]

Rodríguez-Pose, A. (2005), "Is R&D investment in lagging areas of Europe worthwhile? Theory and empirical evidence", *Papers in Regional Science*, Vol. 80/3, pp. 275-295. [72]

Rogers, E. (2003), *Diffusion of Innovations*. [41]

Schneider, J. and J. Hall (2011), "Why most product launches fail", Harvard Business Review, https://hbr.org/2011/04/why-most-product-launches-fail (accessed on 10 December 2018). [48]

Schot, J. and W. Steinmueller (2018), "Three frames for innovation policy: R&D, systems of innovation and transformative change", *Research Policy*, Vol. 47/9, pp. 1554-1567, http://dx.doi.org/10.1016/j.respol.2018.08.011. [51]

Slovenia Government Office for EU Cohesion Policy (2015), *Slovenia's Smart Specialisation Strategy*, http://www.onlines3.eu/wp-content/uploads/RIS3_strategy_repository/SI_S4_dokument_2015_october_eng_clean_lekt.pdf. [62]

Soete, L. (2013), "From emerging to submerging economies: New policy challenges for research and innovation", *STI Policy Review*, Vol. 4/1, pp. 1-13, https://doi.org/10.22675/STIPR.2013.4.1.001. [52]

Som, O. (2012), *Innovation Without R&D*, Gabler Verlag, Wiesbaden, http://dx.doi.org/10.1007/978-3-8349-3492-5. [40]

Stoneman, P. (ed.) (1995), *The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives*, Blackwell Publishers. [28]

Tsipouri, L. (2018), "Fostering innovation in less-developed (with low institutional capacity)", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 22 June 2018, Paris. [10]

Veugelers, R. (2015), "Matching research and innovation policies in EU countries", *Bruegel Working Paper*, http://bruegel.org/2015/12/matching-research-and-innovation-policies-in-eu-countries/. [85]

Veugelers, R. and H. Schweiger (2015), "Innovation policies in transition countries: One size fits all?", *Economic Change and Restructuring*, Vol. 49/2-3, pp. 241-267, http://dx.doi.org/10.1007/s10644-015-9167-5. [81]

Viable Cities (2018), *Mission: Climate Neutral Cities by 2030*, https://en.viablecities.se/ (accessed on 15 January 2019). [75]

Wessner, C. and T. Howell (2018), "Smart specialisation in U.S. regional policy: Successes, setbacks and best practices", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 15 October 2018, Paris. [14]

Wolfe, D. (2018), "Experimental governance: Conceptual approaches and practical cases", Background Report for an OECD/EC Workshop Series on Broadening Innovation Policy: New Insights for Regions and Cities, OECD, 14 December 2018, Paris. [18]

Notes

[1] See https://www.bbc.com/news/technology-39589967 (accessed 23 July 2019).

[2] See, for example, the discussion in OECD (2017[90]) that focuses on the challenge AirBnB poses for Amsterdam (Netherlands).

[3] While the potential exists for all types of firms, SMEs might require additional support to access the benefits big data and data analytics can provide (Bianchini and Michalkova, 2019[92]).

[4] The four sectors (splitting ICT producers and service providers) account for 75% of the total R&D expenditure of the largest 2 500 global private sector R&D investors. As they account for 90% of private sector R&D spending, the underlying assumption is that R&D investing firms excluded from the data have a similar industrial structure (Hernández et al., 2019[35]).

[5] Based on the 2019 OECD Survey of National Innovation Statistics and the Eurostat's Community Innovation Survey (CIS-2016), http://oe.cd/inno-stats, January 2020.

[6] The Fraunhofer IIS provides their view of the history of the development of the MP3 code at https://www.mp3-history.com/ (accessed 19 July 2020).

[7] See also OECD (2019[91]) and the collection of best practices for OECD countries available at https://www.oecd.org/gov/ethics/Going_Green_Best_Practices_for_Sustainable_Procurement.pdf (accessed 22 July 2020).

[8] Regions within the 37 OECD countries are classified on two territorial levels reflecting the administrative organisation of countries. Large (TL2) regions represent the first administrative tier of subnational

government and small (TL3) regions are contained in a TL2 region. TL3 regions correspond to administrative regions, with the exception of Australia, Canada, Germany and the United States.

[9] See the European Reshoring Monitor: https://reshoring.eurofound.europa.eu/reshoring-cases.

[10] Data on trends in responsibility for innovation policy at the subnational level are not readily available. The Regional Authority Index, which measures the authority of administrative regions in general, shows that decentralisation to the regional level is a general trend in all parts of the world. Fifty-two out of 81 countries in the Regional Authority Index experienced a net increase in the degree of regional authority and only 9 experienced a net decline (OECD, 2019[89]).