Chapter 4

Recent trends in national science and innovation policies*

Many governments, across the OECD and beyond, are facing unprecedented economic and societal challenges and consider science and innovation as part of the response. New data from an EC/OECD survey on science and innovation policies shows that governments have particularly focused policy attention and action in recent years on addressing more immediate economic imperatives and building more effective, impactful and responsible policies. Against a background of slow economic growth and tight budgetary conditions, many governments have shifted attention and support away from public research towards business innovation and entrepreneurship, with a view to promoting firms' potential to drive a stronger and more sustainable recovery. Efforts have also been made to reinforce national policy evaluation capacity so as to gain efficiency and to better orient science, technology and innovation (STI) policies towards societal goals.

This chapter presents recent trends in national science and innovation policies across OECD member countries and major emerging economies, including Brazil, China, India, Indonesia, the Russian Federation and South Africa. It considers the economic and financial conditions that determine innovation behaviour and that currently shape the innovation policy agenda. It presents the "hot" STI policy issues in countries as well as the most recent shifts in national policy mixes. This chapter builds on countries' responses to the latest European Commission (EC)/OECD International Survey on Science, Technology and Innovation Policies (STIP) and recent OECD work on science and innovation policies.

* Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Key messages

- Recent global growth performance has been disappointing. Weak market prospects have dampened business investments, including in innovation activities. There are signs that investment in knowledge-based capital (KBC) and research and development (R&D) is levelling off in many countries, even though this had been comparatively dynamic during and since the crisis. Although business R&D expenditure are back to pre-crisis levels after the sharp 2009 decline, small and medium-sized firms (SMEs) are still facing financial difficulties in most countries.
- Countries have been following different paths in building their innovation capacity as national economic conditions have varied: some countries have been on a slow growth path for over a decade (e.g. Japan, several EU members) while others have experienced stronger economic growth (e.g. Korea, Israel, Australia, United States). Noticeable cross-country differences in investment in innovation have also been growing within Europe, signalling a growing threat to the continent's future economic cohesion. Countries trapped on a low-growth path are likely to fall further behind and the gap with global innovation leaders will likely widen.
- Government investment in R&D and exceptional recovery packages partially offset the drop in business R&D during and after the crisis. But in view of prospective budgetary constraints, as well as recent developments in public R&D budgets, which are likely to continue slowing down or retracting in the coming years, the recovery in R&D cannot be driven by public investment any longer.
- Policy makers are increasingly focused on improving the ability of firms to invest in R&D and innovation, as well as on improving the efficiency of the science, technology and innovation (STI) policy mix. Governments have been particularly active in four STI policy areas during 2014-16:
  1. Financing business innovation and entrepreneurship, especially through a remodelling of the policy mix, and increasing support to SMEs and their internationalisation
  2. Rationalising public research spending, improving ties between public and private research and encouraging interdisciplinary research and open science
  3. Ensuring the future supply of talent and building a culture for innovation
  4. Improving STI policy governance, with strong attention given to policy evaluation and the design of responsible research and innovation (RRI) policies.
- To escape the slow growth trap, governments have sought to restore the terms of domestic competitiveness. Raising the transformative innovative capacity of domestic industry is at the core of national STI plans in many OECD countries and emerging economies.
- Globally, STI policy action has slightly changed focus, form and target in recent years. A growing share of public spending for R&D has been allocated to the business sector, instead of the public research system, signalling a shift in strategic objectives (to increasing business capacity to innovate), instruments and targets (firms).

- Streamlining business innovation policy programmes has become a key issue, aiming to make access to public support easier and encourage its broad diffusion. Many countries have consolidated and merged existing support schemes while the total volume of public support was maintained or even increased.
- Governments have implemented a "no spending" approach by privileging policy tools that do not require additional public spending in the short term, particularly public procurement and tax incentives for R&D and innovation.
- Public procurement has become a major feature of innovation agendas and initiatives to spur business innovation through public procurement have multiplied, making this STI policy area one of the most active over the period. Further reforms are likely as a growing number of countries expect demand-side instruments to become more prominent in the future.
- Much policy attention remains focused on the articulation of direct and indirect support to business innovation, essentially through competitive grants and R&D tax incentives, both instruments being of high relevance in the policy mix overall. But the perceived relevance of R&D tax incentives is related to the fiscal cost they generate and their use remains extremely uneven across countries.
- R&D tax schemes have gone through more substantial changes during 2014-16 than in the previous period. As in the past, special features have been introduced to make schemes more generous and better adapted to SMEs and young firms. One more recent trend has been the growing policy intention to aim them more at supporting technology transfer.
- Many countries have refurbished their policy portfolio to assist SMEs and start-ups in accessing global markets. And the internationalisation of clusters, another key channel for SMEs to connect to global knowledge networks, has received greater policy attention.
- Some countries are reviewing their public research policy to improve its efficiency. While there is a global trend towards more competitive funding and contractual arrangements, a small number of countries, particularly in northern Europe, have reversed the trend and increased block funding.
- The sources of public research funding have also changed as a result of greater involvement by industry. Public-private partnerships (PPPs) offer opportunities for sharing risks, resources and orientation. Philanthropic and private science foundations, although still small, are playing an increasingly important role in complementing public funding as well.
- Many countries have readjusted their strategic priority research areas with a view to tackling societal challenges. In addition to lower cross-disciplinary barriers, some countries have reformed the governance of public research and restructured research agencies and actors.
- Efforts towards open science have focused on creating enabling legal frameworks and providing policy guidance for open access and open data. The number of countries with mandatory open access provisions is increasing. Half more countries are engaged in upgrading their infrastructures, or revising their legislation and research funding mechanisms, to encourage open access and open data in 2014-16 than during the previous 2012-14 period.
- Education policy has evolved to reflect the wider range of skills required to innovate. This includes increased budgets to boost science, technology, engineering and mathematics (STEM) education, initiatives to make STEM more attractive to young people, or revised

curricula to develop generic skills, problem-solving capacity and entrepreneurial behaviour.

- Many countries have sought to build "cultures" of science and innovation that will help reinforce public participation in and support for science and entrepreneurship. For instance, there have been efforts to build capacity for the popularisation of science, and to foster an entrepreneurial spirit and increase creativity in the work place.
- Recent trends in policy evaluation include the more intensive use of administrative data and online technology for collecting data ("big data"), smaller and more rapid evaluation exercises and a growing complexity in the concepts and practices employed. In response to the rising risks of misallocation of public resources or negative interactions between instruments, systemic evaluations have spread globally.
- Overall, general efforts have been directed towards building a more evidence-based knowledge base, through the systematisation of evaluation, a whole-of-government approach to evaluation, more harmonised practices and new data infrastructures and expert communities.
- While much STI policy attention is currently focused on the economic slowdown, the ethical and societal dimensions of research have come to the fore and are increasingly reflected in the framing of more "responsible research and innovation" (RRI) policies.
- Governments have paid attention to fostering a comprehensive approach to governance by enhancing co-ordination arrangements across the board and involving industry and society upstream in the policy debate. RRI principles have been integrated into the formulation of innovation policy agendas, mainstreamed in existing funding programmes or have targeted the agencies and institutions in charge of policy delivery (e.g. funding agencies).

Introduction: the legacy of recent years

This chapter presents recent global trends in STI policies.

OECD countries are facing unprecedented challenges. These include growing income inequalities in a context of slow global economic growth, ageing populations, climate change, the depletion of natural resources and other environmental issues, the further fragmentation of global value chains (GVCs), and shifting lifestyle and societal expectations, to name but a few. STI has the potential to trigger a new production revolution and boost productivity, to mitigate climate change and decouple growth and environmental degradation, and to help tackle a broad range of societal challenges and build a more equitable and cohesive society (see Chapters 1 and 2). Acknowledging this potential, governments in the OECD and beyond have strengthened their national STI capacities and moved innovation higher up on the policy agenda (OECD, 2014a).

The way that governments have responded to the recent 2008-09 financial crisis confirms the high status of innovation in national policy agendas (OECD, 2012). Recovery plans in many countries have contained an important dimension of research and innovation (OECD, 2009). Substantial public investment has been dedicated to upgrading STI infrastructures, while public research expenditure played a buffering role in the turmoil by partially offsetting the drop in business spending on R&D. Many governments also strengthened the "green" component in their policy schemes (OECD, 2010). However, in many countries, post-crisis budgetary austerity was already in place by 2013-14, cutting public R&D

budgets and often eroding governments' capacity to act in the field. At the same time, governments have also substantially revised financial support for business innovation and entrepreneurship over the past decade, partly aiming to address the drop in conventional sources of corporate SMEs funding.

This chapter considers a number of issues, including: the recent economic and financial conditions that determine innovation behaviours and that shape innovation policy agendas. It discusses the conditions of public intervention in this STI policy field and presents the "hot" STI policy issues in capitals as well as the most recent shifts in national policy mixes. Recent policy initiatives have been aimed at addressing more immediate economic imperatives, for example by boosting firms' potential to innovate and by achieving more impactful policies; the reorientation of public research systems, for instance towards greater openness; and, attempts to improve STI policy governance, for example through the design of more responsible and ethical STI policies.

The chapter is based on countries' responses to the joint European Commission (EC)/ OECD International Survey of Science, Technology and Innovation Policies (STIP) (Box 4.1). This survey investigates current STI policy challenges, orientations and actions in all OECD member countries as well as in certain non-member economies. More detailed analysis of the survey results is provided in the online *STI Outlook 2016* policy profiles and country profiles.

Box 4.1. **EC/OECD International Science, Technology and Innovation Policy (STIP) Survey**

Starting in 2015, the OECD and the European Commission have joined forces to produce a common survey and database of national STI policies. The survey and the database are unique in their nature, scope and coverage. The survey aims to review on a biennial basis major changes in national STI policy portfolios and governance arrangements. It builds on conceptual work carried out under the aegis of the OECD Committee for Scientific and Technological Policy (CSTP) for mapping the policy mix on innovation (Kergroach et al., forthcoming-a). The survey expands on the former OECD STI Outlook Policy Questionnaire and includes questions relevant to the European Union's research and innovation policy agenda. The scope of the survey covers all areas of STI policy, including initiatives spread across different ministries and national agencies, with competence over domains as broad as research, innovation, education, industry, environment, labour, finance/budget, and others. The responses are provided by government representatives. The CSTP and the European Research and Innovation Committee (ERAC) jointly guarantee the relevance of national input. The responses are harmonised and then incorporated in the STIP Database.

This EC/OECD co-operation brings the survey's coverage to 54 countries, including 35 OECD member countries, key emerging economies (i.e. Argentina, Brazil, the People's Republic of China, Colombia, Costa Rica, Egypt, India, Indonesia, Lithuania, Malaysia, Peru, the Russian Federation, South Africa and Thailand), non-OECD EU member states (i.e. Bulgaria, Croatia, Cyprus, Malta and Romania), plus the European Commission. Taken together, the countries covered in the STIP survey and database account for an estimated 98% of global R&D.

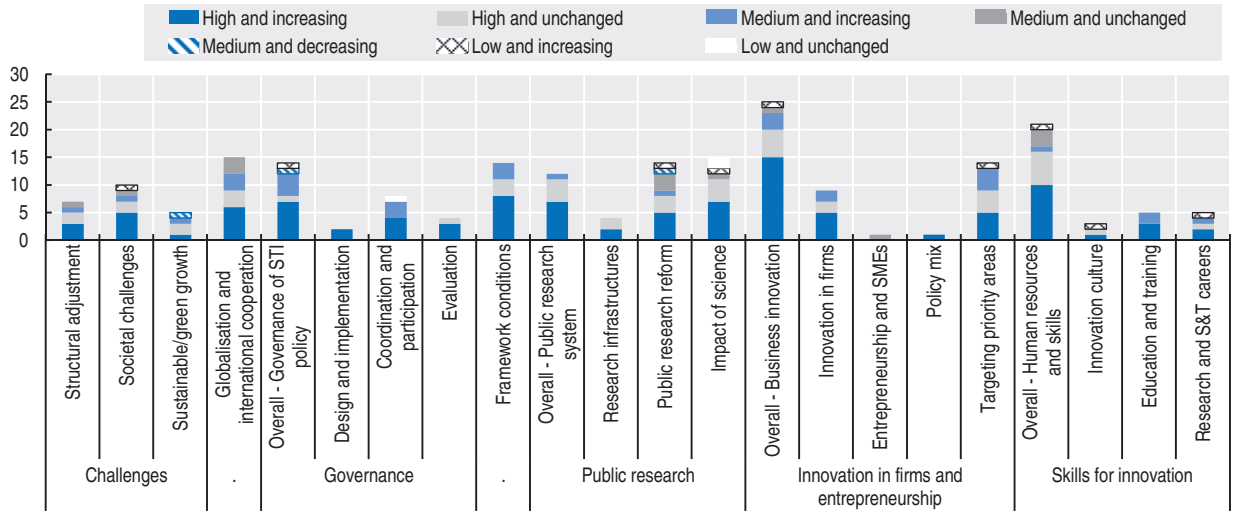
The 2016 STIP Survey took place between the end of October 2015 and early March 2016. 52 responses were submitted over this period of time, i.e. a 95% response rate. The responses were collected through an Excel-based enhanced questionnaire specifically designed for this purpose.

4.1. Overview of the STIP survey results

Country responses to the 2016 EC/OECD International STIP Survey show a high and often growing interest of many governments in strengthening the foundations of the knowledge triangle, i.e. public research, business innovation and entrepreneurship, and skills (Figure 4.1). The most topical STI policy issue ("hot" issue) in 2016 is the role governments could play in encouraging business innovation and entrepreneurship, the topic having become of high and increasing importance in a large number of countries.

Figure 4.1. **Overall STI policy attention is focused on business innovation, research and skills**

Priority areas by degree of importance, total of 52 responses to the 2016 STIP survey



Note: STI policy priorities are defined by a country's self-assessment of the following questions: "1) What are the current major STI policy priorities in your country? Please select three (maximum five) STI policy priorities in the drop-down lists below and rate the degree of importance of each issue. 2) How has the relative importance of these policy priorities evolved in the past five years? Are they of increasing or decreasing importance? Please rate how this importance may have changed in the past five years." The indices of policy priority are calculated on the basis of country ratings. Responses are provided by country delegates to the OECD Committee for Scientific and Technological Policy (CSTP) and the European Research and Innovation Committee (ERAC).

Source: Based on EC/OECD (forthcoming and 2014), *International Database on STI Policies (STIP)*, *www.innovationpolicyplatform.org/sti-policy-database*.

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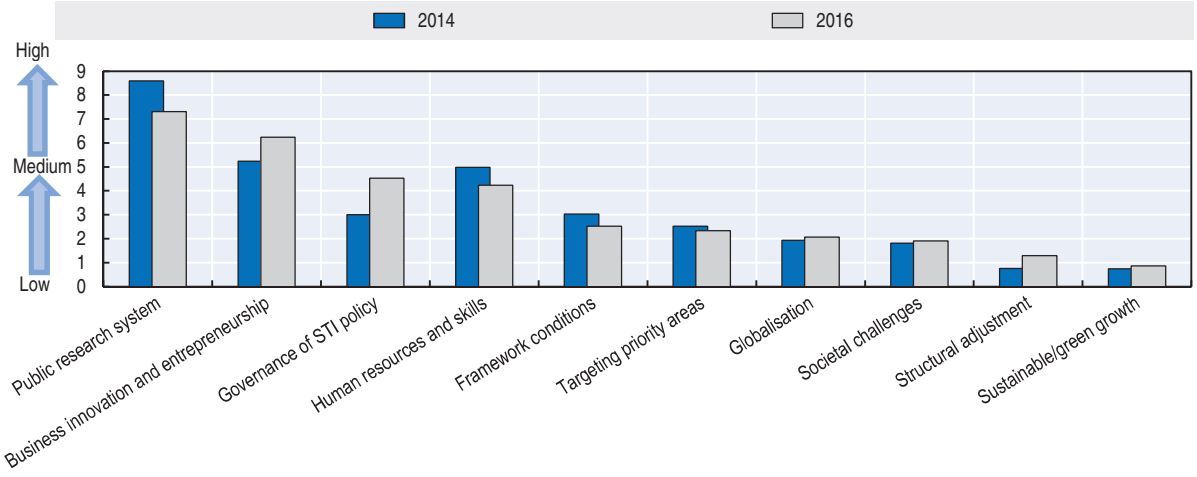
A comparison of 2014 and 2016 responses signals a growing concern among policy makers about improving the ability of firms to innovate and STI policy governance (Figure 4.2). Aggregated responses from the countries for which data were available at these two dates show a slight shift in policy priorities across main policy areas, with business innovation and entrepreneurship, STI policy governance and to a lesser extent structural adjustment gaining in relative importance compared to other policy issues.

Globally, STI policy action has also slightly changed focus, form and target in recent years (Figure 4.3).[1] The STI policy portfolio, i.e. the set number of active STI policy initiatives, has changed in all countries, although some countries have undertaken a deeper overhaul in their policy mix than others. This seems to have been the case in Australia, the Netherlands, New Zealand, Spain or Turkey where new agendas and programmes have been implemented since 2014 and previous initiatives have sometimes been extensively repealed (see also the country profiles).

Changes have also been more substantial in some policy areas than others (Figure 4.3). Policy areas in which governments have been particular active during 2014-16 include:

Figure 4.2. **STI policy focus has shifted towards more immediate economic imperatives and policy efficiency gains**

Index of policy priority by main area, average of the 44 countries participating in the 2014 and 2016 STIP surveys



Note: Comparisons between 2014 and 2016 have been made only for countries that participated in both surveys. 52 countries plus the European Commission (out of the 54 invited to do so) participated in the STIP survey in 2016. The chart thus excludes countries that did not provide ratings in 2014 (Brazil and Egypt) or in 2016 (Denmark and India), and new participants in 2016 (Croatia, Cyprus and Thailand). The index of policy priority is a simple average of country ratings. The values for countries that do not report the field as a priority are null (Kergroach, forthcoming-b).

Source: Based on EC/OECD (forthcoming and 2014), *International Database on STI Policies (STIP)*, *www.innovationpolicyplatform.org/sti-policy-database*.

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1) financing of business innovation and entrepreneurship, especially a remodelling of the policy mix and increased support to SMEs and their internationalisation; 2) public research policy, especially rationalising of public spending and reforms to encourage interdisciplinary research and open science (open science related issues are developed in Chapter 3); 3) skills policy to ensure future supply of talents and to build a culture for innovation; and 4) improved STI policy governance, with a focal attention given to policy evaluation and the design of responsible research and innovation (RRI) policies.

The following sections will provide some contextual information on how the drivers of growth and innovation have weakened since the early 2010s and they will consider the four most active STI policy areas since 2014, as mentioned above, based on policy information drawn from the STIP survey.

4.2. The drivers of growth and innovation have weakened

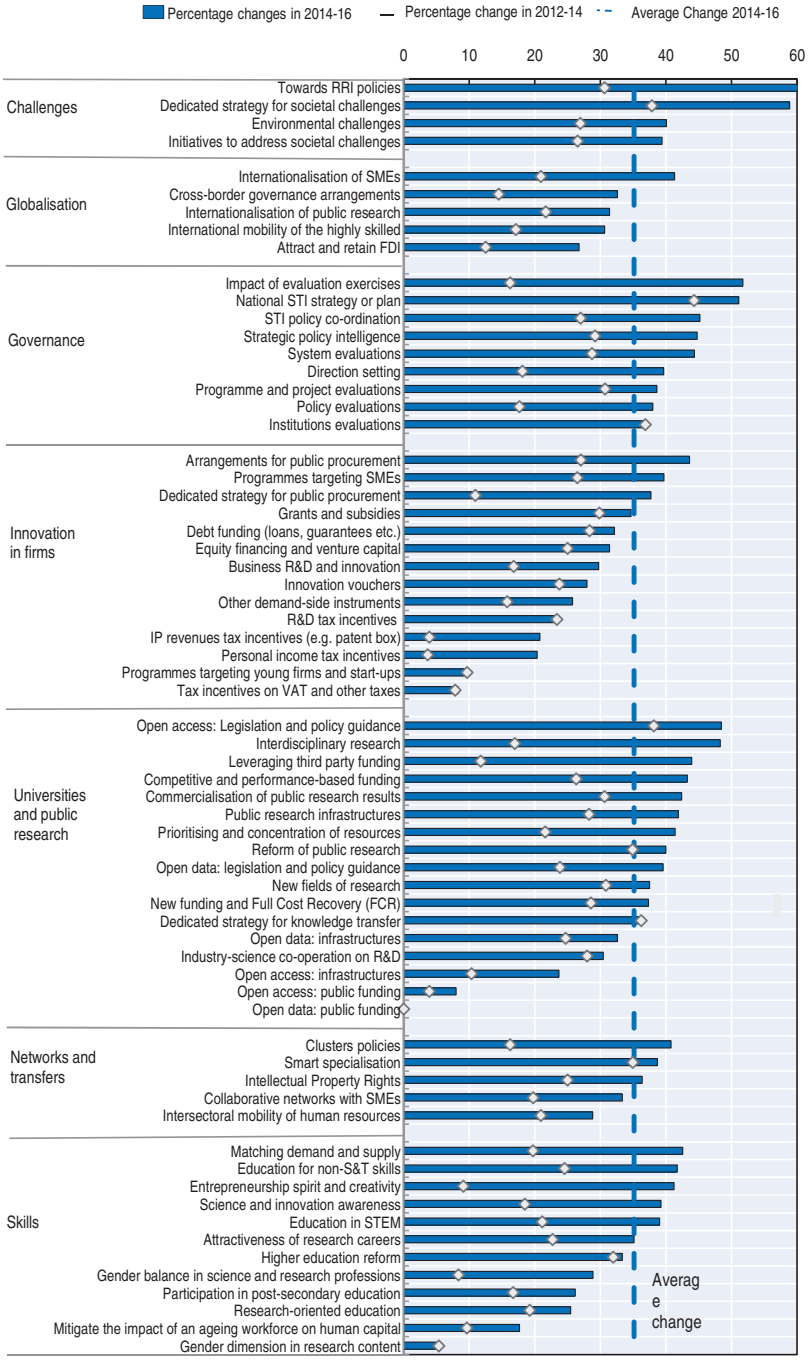
Recent growth performance has been disappointing

Some eight years after the start of the financial crisis, economic growth remains modest in much of the world. Global GDP growth in 2016 (+3.0%) has stabilised at around the 2015 rate, the lowest rate in the past five years (OECD, 2016a).[2] GDP growth rates are well below long-run averages and much lower than would be expected during a recovery phase. And growth forecasts have recently been revised down in light of disappointing recent data.

A rise in global risk aversion led to a sharp retrenchment in global capital and trade flows (IMF, 2016; OECD, 2016a) (Figure 4.4). And the global trade rebound that followed the downturn did not last long. As from 2011, growth in the exports of products and services slowed significantly. Weaker international growth and a slowdown in domestic demand

Figure 4.3. **STI policy action has slightly changed focus, form and target in recent years**

Changes in the policy mix for innovation by policy area, % of policy measures newly introduced, substantially revised or repealed over the period 2014-16



Note: This is an experimental indicator that accounts for the number of major policy initiatives implemented, repealed or substantially revised during 2014-16 as a share of total policy initiatives active at the beginning of the period (Kergroach et al., forthcoming-b). Although simple counts do not account for the magnitude and impact of policy changes, this ratio reflects STI policy focus and activity in specific policy areas and over specific periods of time.

Sources: Based on EC/OECD (forthcoming and 2014), *International Database on STI Policies (STIP)*; and Kergroach et al. (forthcoming-b), "Mapping the policy mix for innovation: the OECD STI Outlook and the EC/OECD International STIP Database", *OECD Directorate for Science, Technology and Innovation Working Paper*.

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have weighed on Chinese production, pulling exports down and hitting emerging markets through commodity trade. The contraction of imports in China and other major emerging economies has also lowered export demand for the advanced economies.

Figure 4.4. **Synopsis of current economic conditions and impact on innovation capacity, selected countries**

Annual growth rates and projections (%), 2000-17

Notes: Exports include products and services. Investments comprise gross fixed capital formation in intellectual property products (including computer software and databases and research and development) and machinery, equipment and weapons systems (including Information and Communications Technology [ICT] investments on computer hardware and telecommunications equipment). Labour productivity is measured as GDP per hour worked. Public R&D budgets comprise government budget appropriations and outlays for R&D. Growth rates are calculated based on values at constant prices.

Sources: Based on OECD (2016a), *OECD Economic Outlook*, June; OECD(2016b), *National Accounts Database*, June; OECD (2016c), *Productivity Database*, July; OECD (2016d), *R&D Statistics Database (RDS)*, April. Data extracted from OECD.Stat on 20-21 July 2016.

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The above developments have all contributed to the lacklustre recovery in the advanced economies. In the United States, the recovery has been led by the private sector and continues to have momentum, but impetus from domestic demand and employment gains are expected to fade as the labour market approaches full employment. In Japan, economic growth and the general outlook remain fragile due to weaker activity in the country's key trading partners, weak private consumption and the further tightening of policies aimed at stabilising the debt-to-GDP ratio.

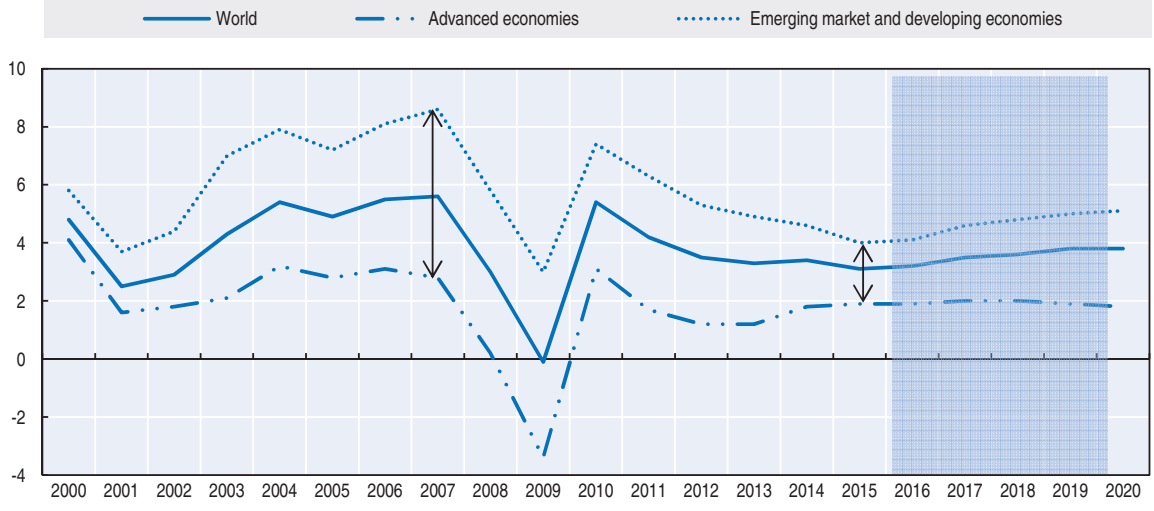
In the euro area, GDP growth is expected to pick up only slowly, with investment remaining weak and unemployment high. The euro area remains stuck on a low-growth

path and is struggling to build confidence to attract investment that could help promote innovation, productivity and employment. The European Union is also facing major political challenges (including refugee crisis, external security threats, unpopular austerity measures, anti-European movements, and the implications of the recent United Kingdom decision to exit the Union). These challenges jeopardise cohesion and may further dampen investment (ESPAS, 2015). The slow European recovery is an important factor dragging on the global recovery and leaves the zone vulnerable to global shocks.

Growth has slowed in the catching-up emerging economies, following the pattern of recent years (Figure 4.4). The structural shift towards services in China, together with overcapacity in Chinese industry, will continue to affect that country's growth outlook (Figure 4.5). The recession in Brazil is likely to deepen, with the country plagued by political uncertainty and rising inflation. The contraction in Russia may have bottomed out, but recovery is still tied to fluctuating oil prices. The growth outlook is more robust in India, although recent flooding threatens progress. The deterioration of growth prospects has led to falling equity prices and greater market volatility, worsening some emerging markets' vulnerability to exchange rate movements and high domestic debt.

Figure 4.5. **Shrinking growth gaps between advanced and emerging economies**

GDP growth, annual rates and projections (%), 2000-20



Source: IMF (2016), *World Economic Outlook*, April.

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Investment in intangible assets seems to be slowing

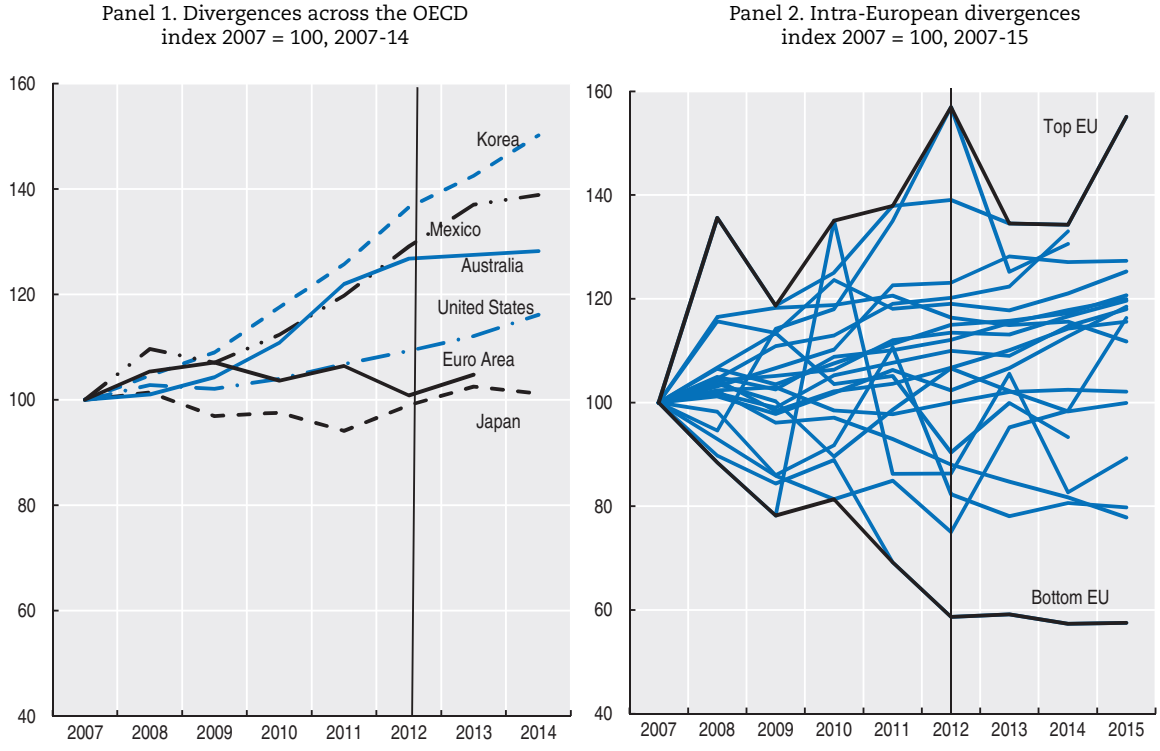
Despite difficult funding conditions and adverse market prospects, economic actors have ring-fenced their investments in intellectual property products (e.g. computer software and databases, and R&D) as compared to other types of physical investments, including in ICT (Figure 4.4). While investments in machinery and equipment have fallen sharply, investments in intangible assets[5] have weathered the crisis better and recovered earlier (OECD, 2014a). For example, R&D spending in the OECD had risen to pre-2007 levels by 2012.

However, there are signs that investment in knowledge-based capital (KBC) is levelling off in many countries, especially since 2012 (Figure 4.6). National accounts data, which have recently included R&D in gross fixed capital formation, indicate that such investment has been slowing in Australia, Israel, Japan and many European countries, even though

these areas had experienced strong growth in their intellectual assets portfolio over recent years (Figure 4.4 and 4.5). Likewise, recent OECD calculations based on data from the INTAN-Invest network show a continuous downward trend in spending on organisational capital of firms and in firm-specific training in the European Union and the United States since 2007 (OECD, 2015a).

Figure 4.6. **Cross-country investments in intellectual assets**

Gross fixed capital formation, intellectual property products, index 2007 = 100, 2007-14/2007-15



Source: Based on the OECD (2016), *OECD National Accounts Database*, July. Data extracted from OECD.Stat on 20 July 2016.

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The picture nevertheless differs greatly across economies. Several countries, including Estonia, Korea, the United Kingdom and the United States, continue to increase their investment in KBC portfolios. Consequently, cross-country divergences in innovation capacity are growing (Figure 4.6). Previous editions of the *STI Outlook* noted that the uneven economic recovery was expected to widen the gap between countries experiencing flat or low growth (and which may have difficulty maintaining R&D expenditure) and countries experiencing higher growth (and thus good conditions for expanding national R&D) (OECD, 2014a). The same National accounts data show that intangible assets investments have been very dynamic during the crisis, including in recent years, in Korea, Israel and Australia (Figure 4.6). Such investments have also recovered markedly in the United States since 2010, but have grown only slowly in Japan and the euro area. Noticeable cross-country differences in investment profiles exist even within Europe, signalling a growing threat to the continent's future economic cohesion.

Innovation results from an accumulation process, i.e. accumulation of knowledge, capital and technology. If economic conditions remain weak, as the expected slowdown of

global growth foreshadows (see Chapter 1), countries trapped on a low-growth path could struggle to maintain their innovation investments and capacity. In the medium-term, the gap between the global innovation leaders and the many others is likely to further enlarge.

Productivity growth is low and public budgets are under pressure

The decline in business dynamics combined with a general slowdown in KBC accumulation has amplified a slowdown in productivity growth (Figure 4.4) (OECD, 2015b). This slowdown started in many OECD countries before the financial crisis, due partly to the structural shift towards services and to a slowdown in investment which began in the 2000s. Productivity is the driving factor of economic growth in the medium- and long-term, and the slowdown in productivity has been the main driver of the lacklustre growth performance over the past decade.

Weak economic conditions have also reduced tax revenues and public budgets, including for STI. Increased government support for national R&D efforts has partially offset the drop in business R&D during and after the crisis (OECD, 2014a). But, in view of the budgetary outlook and developments in public R&D budgets generally, the recovery in R&D cannot be driven by public investment. Indeed, OECD government budget appropriations and outlays for R&D (GBAORD) have tended to fall in 2014-16 (Figure 4.2), receding or levelling off in almost all OECD countries and the major emerging economies and following immediate post-crisis trends (OECD, 2014a, 2016e).

A low-growth equilibrium, characterised by low demand, low investment, low inflation, low wage growth and weak productivity growth, is hampering further improvements in living standards, income redistribution and the consolidation of public budgets. To address this situation, a recovery in private sector investment and wage growth is needed (OECD, 2016f forthcoming), with innovation playing an important part to reactivate business dynamics and productivity growth.

4.3. Escaping the slow growth trap and strengthening economic growth

Restoring the terms of competitiveness

National innovation strategies are increasingly integrated into countries' competiveness agendas and raising the transformative capabilities of domestic firms is at the core of national STI plans. Some major initiatives have recently been implemented by some of the large innovation players and at EU level (see also the policy profile "National strategies for science, technology and innovation").

- Australia has adopted its National Industry Investment and Competitiveness Agenda (IICA) in 2014 and established a ministerial taskforce to promote productivity through innovation and R&D. As part of this new agenda, the government has made industrial policy and the translation of publicly funded research into commercial outcomes key pillars of its approach to strengthening economic dynamism. The release of the National Innovation and Science Agenda (NISA) in 2015 further builds on the IICA. The NISA aims to boost Australia's science and innovation in the four key areas of capital and culture, collaboration, talent and skills, and government as an exemplar.
- Germany's High-Tech Strategy has been revised in 2014 with a view to better integrating market perspectives on specific technology areas and the need to address societal challenges. The 2014 revision places an emphasis on innovative small and medium-sized enterprises (SMEs).

- In Japan, the 5th S&T Basic Plan (2016-20) provides the medium- to long-term orientation of national STI policy and addresses *inter alia* the policy challenges of increasing the competitiveness of manufacturing.
- Korea released its Action Plan for implementing its 3rd S&T Plan in 2015. USD 21 billion (KRW 19 trillion) have been earmarked for national R&D investment and, among other objectives, to develop strategic technologies and create new industries.
- The new UK Productivity Plan aims to provide the necessary environment and infrastructure to facilitate innovative processes in the research and business-to-business sectors. As part of it, the Competition Plan sets out a number of policies to improve the business environment and ensure wider competition.
- The United States updated its Strategy for American Innovation in 2015 to serve as a guiding reference for investing in the building blocks of US innovation and promote competitive markets and productive entrepreneurship.
- A 2014 Communication at the EU level provides an assessment of how the innovation economy promotes competitiveness and provides an evidence base for identifying priority investments and making research and innovation new sources of growth.

The potential of research and innovation to contribute to economic performance and productivity has also been further emphasised in key emerging economies. The 13th Five-Year Plan (2016-20) aims to strengthen China's science and technology (S&T) competitiveness and international influence and develop breakthroughs in core and critical technology areas in order to support economic restructuring and industrial upgrading. Brazil's new National STI Strategy (ENCTI) (2016-19) intends to address its technological gap and targets a few promising industries (renewables, subsea oil, space, ICT etc.). The Russian Federation announced in 2015 its National Technology Initiative, a new long-term model to achieve technological leadership, through novel technology-based markets (for instance non-piloted drones for the industrial and services sectors, neurotechnological products, network-based solutions for customised food delivery). Mexico's Special Programme for STI (PECiTI) (2014-18), Peru's National Plan for Production Diversification (PNDP) (2014 onwards), Thailand's Ten-Year STI Plan or Turkey's Tenth Five-Year Development Plan (2014-18) are similar initiatives aimed to raise national competitiveness through R&D and innovation.

Boosting firms' potential to innovate

Financing conditions for innovation remain weak, especially for SMEs. Finance for entrepreneurship was affected heavily by the crisis (OECD, 2012; 2014a; 2015c). Small firms are still struggling to restore their profit margins, which remain their main source of financing (Figure 4.11, Panel 1). External sources of funding, such as bank credit, venture capital and business angels investment, have become more accessible, but at a slow rate and unevenly across countries.

The situation of large firms is different. First, large businesses depend less on bank loans for investment in innovation, notably multinational companies. They have therefore been less sensitive to banks' restrictive policies in past years. Second, their profitability also recovered rapidly after the crisis and some firms have large cash reserves that are not being invested. Uncertainty on the demand side and risk aversion on the supply side contribute to relatively poor business prospects and low investments, and limit the potential for an upswing in innovation activities.

Although most business-performed R&D is still financed by industry (on average 86.5% for OECD countries in 2013; OECD, 2016f), public funding support has increased significantly over the past decade, both in absolute and relative terms (Figure 4.7) (OECD, 2014a; 2015a). In Canada, Chile, France and Hungary, more than a quarter of business R&D is funded through combined direct and indirect financial support and the public contribution peaks at 62% in the Russian Federation (Figure 4.7, Panel 1). The share of business expenditure on R&D (BERD) publicly funded has increased markedly in Belgium, Ireland, Iceland, France and Canada over the period. The intensity of public support has also increased as a percentage of GDP in almost all countries since 2006 and the increase has been particularly marked in Slovenia, Belgium, France and Ireland (Figure 4.7, Panel 2) (see also the policy profile "Government financing of business R&D and innovation").

A growing share of the government budget for R&D has been allocated to the business sector, instead of public research, signalling a policy shift in strategic objectives (increasing firms' capacity to innovate), instruments and target (firms).[3] The policy shift has been driven by increasingly generous R&D tax arrangements (Figure 4.8). Between 2006 and 2013, the amount of tax revenues foregone for R&D has increased in most countries for which data are available. In these countries the share of government funds going to business R&D has also increased faster than the share going to public research.

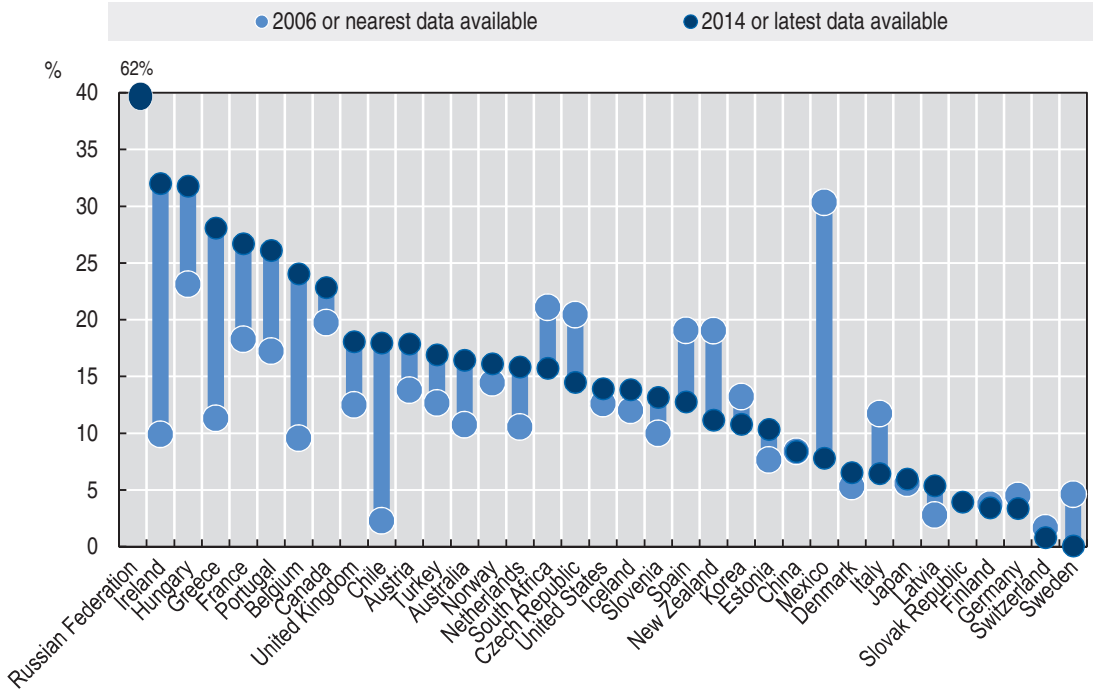
Still, direct funding through grants, debt financing and public procurement remains the main channel of public support for business R&D in many countries. Grants, equity financing and debt financing instruments (e.g. loans, guarantees and risk-sharing mechanisms) are the most frequently used policy instruments in the 52 countries that participated in the 2016 STIP Survey (Figure 4.9). They are also, together with tax incentives and technology consulting, of growing relevance in the policy mix in many countries. Yet, much policy attention remains focused on the use of competitive grants and tax incentives for R&D, both instruments being considered the most relevant in the policy mix in a majority of countries.

Yet, the mix and relative balance between STI funding instruments vary significantly across countries and although there are some converging trends in STI policy globally (see Chapter 1 on "Megatrends affecting science, technology and innovation"), there are also well-established national archetypes of business innovation policy. For example, Belgium, Canada, France and the Netherlands have adopted a strong indirect funding approach towards business support, in using R&D tax incentives. But Estonia, Finland, Germany, Mexico, Switzerland and Sweden provide only direct support. China stands as an exception with its large equity funding portfolio (see also the policy profile "Government financing of business R&D and innovation").

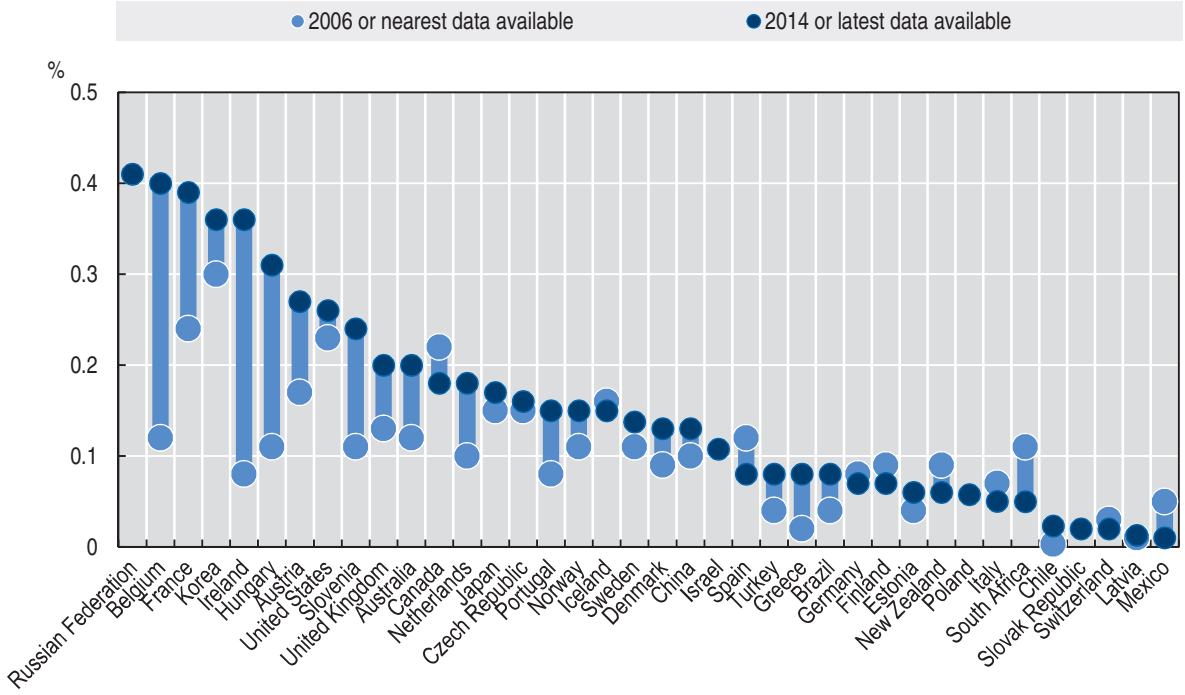
Recent developments in direct funding rely more on market-friendly approaches, encouraging competition-based selection and streamlining public support schemes (OECD, 2012; 2014a). Streamlining science and innovation policy has become a key issue in many OECD countries and non-OECD economies due to the growing complexity of innovation policy and the budgetary austerity that currently weigh on national public accounts. Streamlining policy programmes also contributes to making access to public support easier and encouraging their broad diffusion. In 2014-16, this trend towards a simplification of policy delivery continued and many countries, including those previously engaged in streamlining their portfolio, have consolidated and merged existing support schemes. Yet, only few saw a negative impact on the total volume of public financial support allocated (Figure 4.10). On the contrary, for several countries, including Belgium, Sweden, Turkey and emerging economies (Brazil, Colombia, Costa Rica and Indonesia), these revisions in the

Figure 4.7. **Public support to business R&D has increased significantly over recent years**

Panel 1. Combined direct and indirect financial support, as a percentage of BERD, 2006 and 2014



Panel 2. Combined direct and indirect financial support, as a percentage of GDP, 2006 and 2014



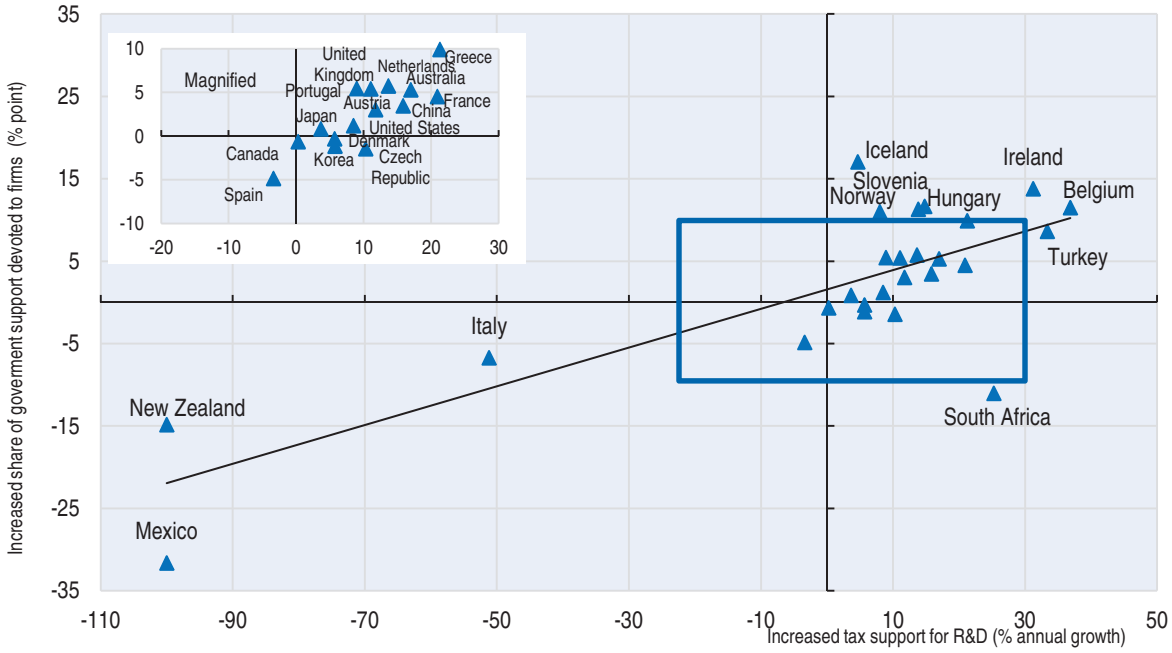
Sources: Based on OECD (2016f), *OECD Research and Development Statistics (RDS) Database*, April, *www.oecd.org/sti/rds*; and OECD (2016g), *OECD-NESTI data collection on R&D tax incentives*, July, *www.oecd.org/sti/rd-tax-stats.htm*. Data retrieved from IPP.Stat on 8 August 2016.

StatLink http://dx.doi.org/10.1787/888933433581

policy mix have come with further increases in public support. Finland stands as an exception as the only country reporting a cut in the total number of schemes in place and the total amount of public support provided.

Figure 4.8. **More public support has gone to firms through more generous R&D tax incentives**

Percentage change in the relative share of public support granted to firms (y-axis) and annual growth of R&D tax cost estimates (x-axis), 2006-14 or nearest years available



Note: Countries for which two data points were not available for a comparison in time are not represented in the chart.

Sources: Based on OECD (2016f), *OECD Research and Development Statistics (RDS) Database*, January 2015, *www.oecd.org/sti/rds*; EC/OECD (forthcoming), *International Database on Science, Technology and Innovation Policies (STIP)*, 2016 edition, *www.innovationpolicyplatform.org/sti-policy-database*; and OECD (2016g), *OECD-NESTI data collection on R&D tax incentives*, July, *www.oecd.org/sti/rd-tax-stats.htm*. Data retrieved from IPP.Stat on 11 September 2016.

StatLink http://dx.doi.org/10.1787/888933433595

In the aftermath of the crisis, countries have increasingly emphasised debt and equity financing in their policy mix for innovation and entrepreneurship in order to compensate for limited private funding (OECD, 2014a).

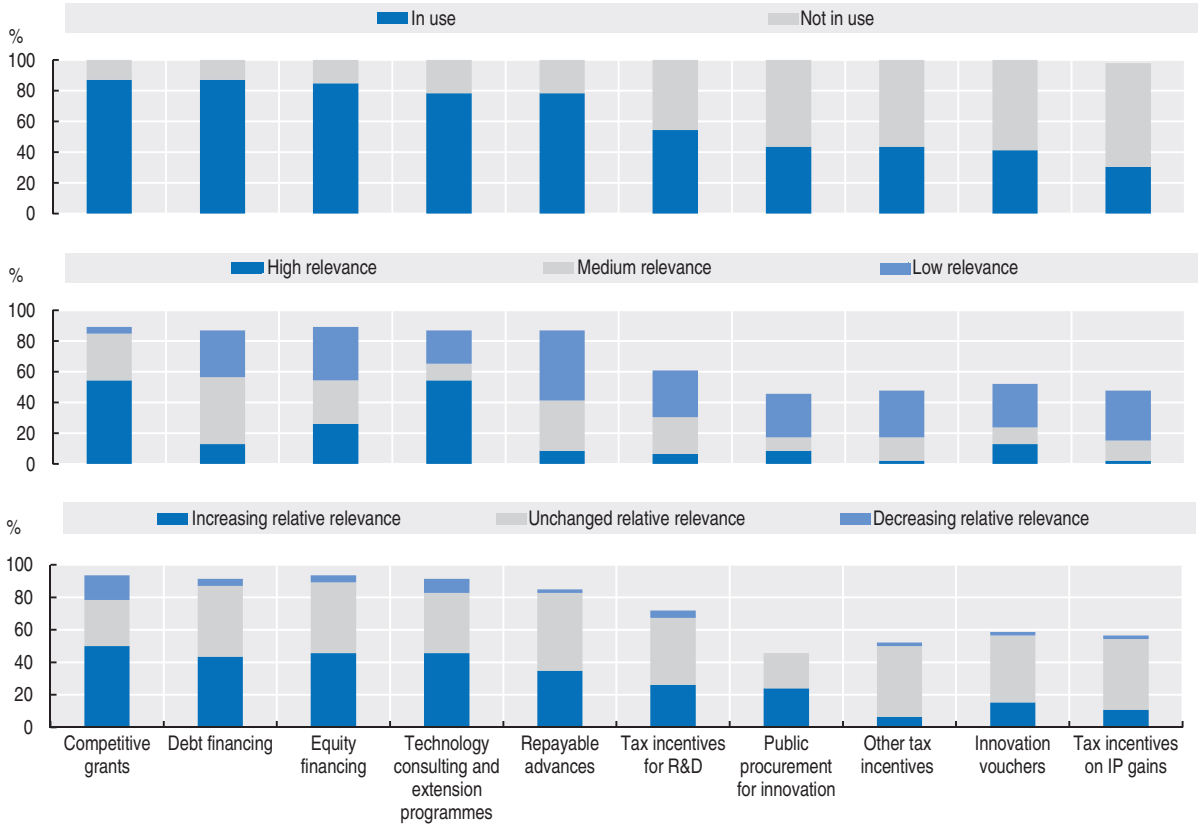
Credit conditions have been easing slowly recently, as banks have achieved required levels of deleveraging, and the overall perceived availability of bank loans improved (ECB, 2016; OECD, 2016h). Nevertheless, many countries are struggling to replenish their credit offer to SMEs and the stock of outstanding SME business loans held by banks is still shrinking in many countries, including Canada, the United States and several European countries (Figure 4.11, Panel 2). Governments have extensively used loan guarantees and risk-sharing mechanisms to give SMEs easier access to funding (OECD, 2014a; 2016h). And further recent efforts have been made in this direction between 2014 and 2016 in Austria, Latvia, Poland and the United Kingdom.

The financial crisis widened the investment gap, particularly at the seed and early stages of business development when firms lack collateral to access bank funding. Equity investments fell sharply during the downturn, and have been slow to recover since (OECD, 2012; 2014a). In 2014, venture capital (VC) investments were back to their pre-crisis levels only in Hungary, Korea, the Russian Federation, South Africa and the United States (OECD,

2015c). The dynamism of the US private equity market is striking, as investments doubled in 2014-15. The situation in the EU area is more lacklustre, especially at the earlier stages of business development (Figure 4.11, Panel 3). In contrast, business angel activities generally rose from 2007 to 2015 (OECD, 2016h; EBAN, 2016). Angel investors play a key role in the start-up ecosystem (OECD, 2011). They typically provide the first round of equity capital, after funds from founders, friends and family have been exhausted. They also provide services beyond financing that are key to success, such as mentoring, business advice and access to networks. Angel activities are also more resilient to business cycles than VC investments and bank credit. The number of business angel groups and networks increased steadily in the United States and the EU area over the past decade. US angel investments reached an estimated USD 24.1 billion in 2014. Angel groups and activities are also gaining ground in many emerging economies.

Figure 4.9. **Major funding instruments in the policy mix for business innovation, 2016**

As a percentage of total country self-reported responses, 52 countries participating in the STIP survey 2016



Note: Simple counts of country responses to the question: "Please describe your country's policy mix. Which of the following public funding instruments of business R&D and innovation are in use in your country? Which are the principal instruments of public funding of business innovation in your country? How has the relative balance between these instruments changed recently, if at all? Please rate the relative relevance of the following financial instruments in your country's policy mix and indicate whether their share in the total has increased/decreased or is remained unchanged". Responses are provided by delegates to the OECD Committee for Scientific and Technological Policy (CSTP) and the European Research and Innovation Committee (ERAC).

Source: Based on EC/OECD (forthcoming and 2014), *International Database on STI Policies (STIP)*, *www.innovationpolicyplatform.org/sti-policy-database*.

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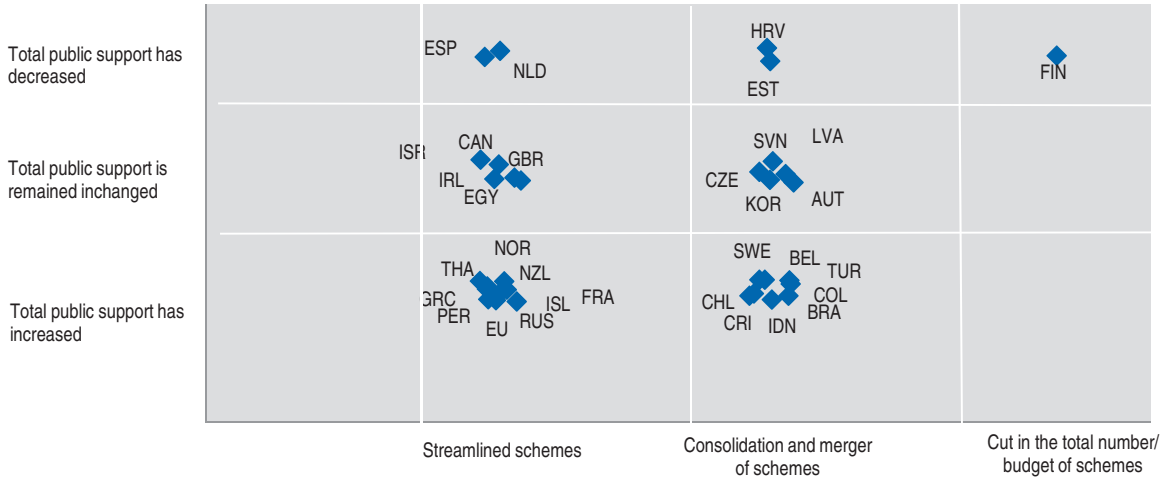
Governments have consolidated domestic equity markets, especially for seed capital, through new or refunded venture capital funds and funds-of-funds (Belgium, Czech Republic,

Figure 4.10. **Many countries have consolidated and merged existing support schemes**

Country self-reported assessment



Note: Country positions on the chart are defined by a country's self-assessment of the following questions: "Have business innovation support schemes been streamlined?, consolidated? or cut in the past two years?" and "From a fiscal perspective, has the total volume of public financial support to business innovation remained unchanged? Or has this policy streamlining/consolidation led to increases/ decreases in public support?". Only countries that answered both questions are presented in the chart.

Source: Based on EC/OECD (forthcoming), *International Database on STI Policies (STIP)*, *www.innovationpolicyplatform.org/sti-policy-database*.

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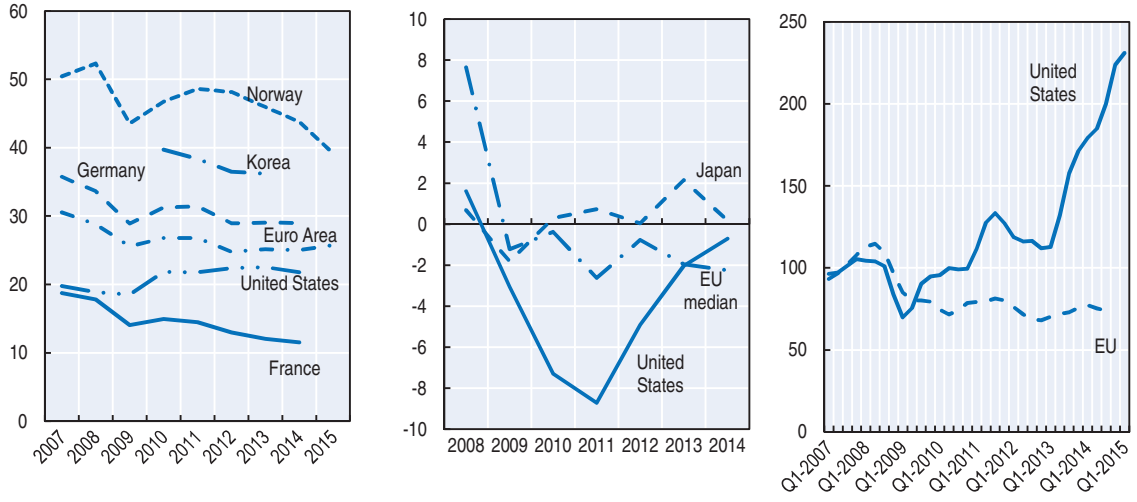
Figure 4.11. **Addressing the slow recovery of financing conditions for innovation and entrepreneurship**



Note: The profit margin rate is the net operating surplus as a percentage of net value added of non-financial corporations.

Source: Based on OECD (2016f forthcoming), *OECD National Accounts at a Glance 2016*.

Note: The EU median is calculated using countries for which data are available. See methodology and notes in OECD (2016h).

Source: Based on OECD (2016h), *Financing SMEs and Entrepreneurship 2016*.

Source: Based on OECD (2015c), *Entrepreneurship at a Glance 2015*.

StatLink http://dx.doi.org/10.1787/888933433623

France and Italy). There are also new support schemes for business angels and new co-investment facilities (Australia, France, Iceland, Poland, Spain and at the EU level). Some countries have deployed both types of instruments so as to cover the full spectrum of

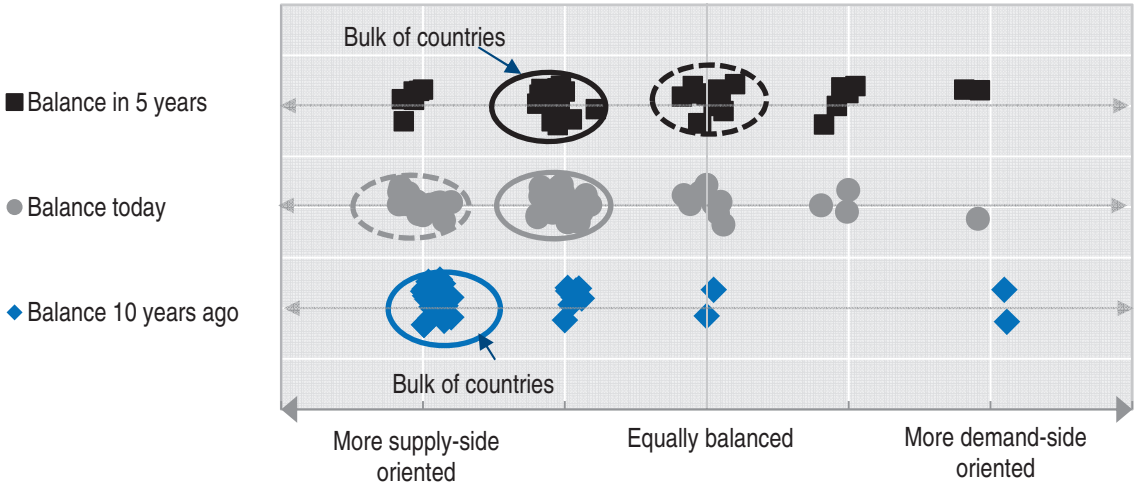
needs for funding innovation (Greece, Netherlands). Portugal has launched a mezzanine fund that combines elements of debt and equity funding (see also the policy profile "Government financing of business R&D and innovation").

While much of recent policy attention has further focused on the potential of business innovation and entrepreneurship to boost economic growth (Figure 4.1), government support in the area has slightly changed its focus, forms and targets (Figure 4.3). In view of their current budgetary situation, many governments have implemented "no spending" policy approaches. They have favoured policy tools that do not require additional public expenditure in the short term, particularly public procurement, and tax incentives for R&D and innovation[4] (see also the policy profiles "Government financing of business R&D and innovation" and "Tax incentives for R&D and innovation").

Governments have increasingly adopted a broader approach to innovation policy by stimulating demand for innovation, especially in areas of pressing societal need where government action can complement market mechanisms with minimal financial outlays (see the policy profile "Stimulating demand for innovation"). Public procurement, which accounts for an average 12% of GDP in the OECD area, has been a focal point of policy attention across ministries in recent years (OECD, 2015d). In the STI policy domain, there has been a notable shift away from the long-standing focus on supply-side instruments over the past decade (Figure 4.12). Many countries indicated in 2014 that the next five years would see increased emphasis on demand-side instruments, though the majority expected supply-side instruments to remain dominant (OECD, 2014a). Since this time, governments' initiatives to spur business innovation through public procurement have multiplied, which make this STI policy area one of the most active over the period (Figure 4.3).

Figure 4.12. **Towards a stronger focus on demand-side approaches in the policy mix**

Changing balance in the policy mix for business innovation, country self-reported assessment



Note: The balance in the policy mix for business innovation is defined by country self-assessment answers to the question: "What is the balance between different types of policy instruments in the policy mix for business R&D and innovation? How has this balance shifted over time and is forecasted to change in the coming years? Please rate the balance between the following types of policy instruments according to their relative importance/significance in the innovation policy mix". Responses are provided by delegates to the OECD Committee for Scientific and Technological Policy (CSTP) and the .European Research and Innovation Committee (ERAC).

Source: Based on EC/OECD (forthcoming), *International Database on STI Policies (STIP)*, *www.innovationpolicyplatform.org/sti-policy-database*.

StatLink http://dx.doi.org/10.1787/888933433631

Many countries have revised their governance arrangements for using public procurement to stimulate innovation. Public procurement has become a major feature of innovation agendas (Australia, Canada, Croatia, Korea, Latvia and New Zealand), entrepreneurship plans (Estonia), smart specialisation strategies (Greece, Hungary), industrial plans (Turkey) and public sector innovation policies (Israel). Sweden is currently working on a strategy for public procurement and has set up a National Agency for Public Procurement. The Netherlands has published a new action plan and committed itself to public procurement which is fully sustainable. Public procurement initiatives to improve dialogue between procurers and suppliers (Ireland), to disseminate best practices (France, Netherlands) and to design and respond to innovation-friendly public tenders (France) have sprung up. Some countries are also offering targeted financial support: Korea has introduced a 20% discount on procurement fees for high-quality products. And legal frameworks and procedures have been revised to simplify access to procurement markets (Italy, Latvia, Turkey), especially for small firms and start-ups (Japan, Korea). Further reforms in public procurement practices are likely as more countries – in 2016 compared to 2014 – expect demand-side instruments to become more prominent in the future (Austria, Chile, Costa Rica, Germany, Korea, Lithuania, Portugal and Thailand).

Although less commonly used than grants and other direct funding instruments overall, R&D tax incentives have increasingly complemented direct subsidies as international restrictions (e.g. European Union, WTO) capped the volume of direct state aid. Since the early 2000s, R&D tax reliefs have been simplified (e.g. by abandoning incremental design) and made more generous (e.g. by increasing the tax relief rate) and more accessible to a larger number of recipients (e.g. by raising or removing the ceiling on eligible expenditures). The policy shift has been particularly noticeable in some countries where indirect support has even replaced direct funding (e.g. France). The growing popularity of R&D tax incentives has also given a considerable boost to global efforts to build evidence on their incidence and impact (for a comprehensive summary, see Appelt et al., forthcoming).

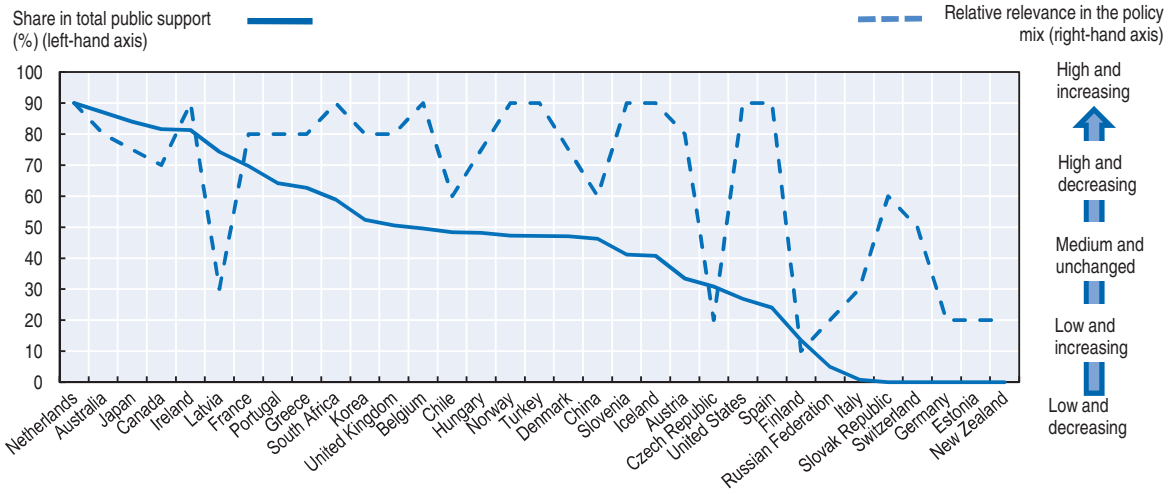
If more governments have introduced favourable tax schemes for innovation over time, the relative relevance of these schemes in the overall policy mix remains extremely uneven across countries. In many countries, tax relief accounts for a minor share of total public support granted to business innovation, the OECD average being around 33% (Figure 4.13). At the top of the ranking are countries giving high and increasing importance to this type of instrument. At the bottom of the ranking are countries giving these instruments medium or low importance. The perceived relevance of R&D tax incentives is closely related to their relative cost, as compared to other direct funding instruments in the total public envelope for R&D. It is, however, worth noting that many countries in the middle of the ranking – those where indirect funding accounts for 10% to 50% of total public funding – considers the issue with greater attention than their level of fiscal concessions would suggest.

R&D tax schemes were relatively stable over the 2012-14 period, making them one of the STI policy areas that changed least globally (OECD, 2014a). More changes have nevertheless been observed between 2014 and 2016. New R&D tax schemes (Latvia, Slovak Republic) and payroll withholding tax credits (Spain) are now in place. As in the past, special features have been introduced to make existing schemes more generous, e.g. through a higher tax relief rate (Austria), an increased expenses deduction rate (Russian Federation, Thailand), or a higher ceiling on the limit of the tax liability that can be offset with R&D tax credits (Norway, Spain). New schemes and revised features also aim to make

tax relief more accessible and better adapted to SMEs and young firms (Croatia, Latvia and the Netherlands), e.g. by reducing the administrative burden for applicants or allowing loss-making firms (typically at early stages of development) to benefit (see also the policy profile "Tax incentives for R&D and innovation").

Figure 4.13. **The use and policy relevance of R&D tax incentives remain extremely uneven across countries**

Tax support as a percentage of combined direct and indirect public support to firms in 2014 (left-hand axis) and relative policy relevance of tax incentives in 2016 (right-hand axis)



Note: The index of relevance reflects the relative importance of tax incentives for R&D in the policy mix and how the relative balance between instruments may have changed recently. Rating is provided by country self-assessment. Countries for which an index of relevance is not available (i.e. Japan, Denmark, Hungary, Russian Federation, Poland, Luxembourg and Mexico) are marked with a dotted line.

Sources: Based on EC/OECD (forthcoming and 2014), *International Database on STI Policies (STIP)*, *www.innovationpolicyplatform.org/sti-policy-database*; OECD (2016f), *OECD Research and Development Statistics (RDS) Database*, April, *www.oecd.org/sti/rds*; and OECD (2016g); OECD-NESTI data collection on R&D tax incentives, July, *www.oecd.org/sti/rd-tax-stats.htm*. Data retrieved from IPP.Stat on 8 September 2016.

StatLink http://dx.doi.org/10.1787/888933433645

One key trend in tax concessions for innovation is the policy intention to use them to encourage technology transfer. This has entailed preferential treatment for collaborative R&D expenditures or knowledge services purchased from universities and public research institutes (Italy, Latvia), accelerated depreciation for the acquisition of new technologies and new knowledge (Poland, Russian Federation) and preferential tax treatment for the acquisition of intangible assets (Australia). In addition, the Russian Federation has deployed a range of VAT or property tax exemptions for research centres located in clusters. In Turkey, firms in Technology Development Zones (TDZs) benefit from a range of tax incentives and are required to establish an incubation centre and a technology transfer office.

Tax concessions are also more closely tied to job creation and labour costs in several countries. The Italian Stability Law 2015 foresees a range of incentives on labour tax and local taxes to encourage job creation and reduce workforce costs. The new Spanish payroll withholding tax credit aims to foster R&D-related employment by business firms and innovative organisations.

R&D tax incentives have become a way to increase the attractiveness of the national research ecosystem and to engage in tax competition to attract foreign R&D centres. In 2013, the United Kingdom introduced an R&D expenditure credit (RDEC) to attract large company investments. From 2016 this scheme fully replaced the previous tax credit.

Some governments have increasingly combined these expenditure-based instruments with so-called "patent boxes" to encourage the co-location of R&D and manufacturing activities. Patent boxes offer tax relief on intellectual property (IP) revenues and aim to boost the domestic exploitation of new technologies and knowledge so as to better appropriate the benefits, including job creation and knowledge spillovers. Patent boxes particularly target large multinational companies that have the capacity to develop global tax optimisation strategies and to decouple the production of knowledge from its use. Recently, Indonesia, Ireland, Portugal, Thailand and Turkey introduced corporate tax exemptions for income derived from the use of intellectual property. In the Russian Federation, operations involving the protection and commercialisation of intellectual property rights (IPRs) have been exempted from VAT since 2015. The US Congress is also considering introducing an innovation box as part of a broader corporate tax reform (KPMG, 2015). However, patent or innovation boxes are increasingly denounced as harmful tax practices that could encourage global tax competition and result in corporate profit shifting and tax base erosion. At the end of 2015, the United Kingdom published draft legislation with a view to better align its patent box regime with OECD standards on harmful tax practices (see the policy profile "Tax incentives for R&D and innovation" for further dicussion).

Governments have also sought to encourage less conventional funding approaches. Indeed, the financing of innovative entrepreneurship will remain a major issue in the coming years. SME dependence on bank finance is increasingly viewed as problematic (OECD, 2016h). Alternative forms of funding are on the rise, driven by the deployment of information and communication technologies (ICTs), peer-to-peer practices and the growing valuation of intellectual assets. Asset-based funding allows firms to obtain financing against the value of the specific assets they produce in doing business, including intangible assets. Similarly, crowdfunding allows entrepreneurs to raise external funds from a large audience, rather than a small group of specialised investors, with each individual providing a small portion of the total funding needed. Typically, internet platforms help match investors with businesses.

While these mechanisms remain small and marginal, they are developing rapidly and may bring new opportunities provided that the right regulatory frameworks are in place (Box 4.2). Australia has passed new legislation to allow crowd-sourced equity funding and provide tax incentives to investors. Austria has adopted a regulatory framework for improving alternative means of financing of innovation, especially crowdfunding. Legal requirements regarding the basic information required and administrative declarations (e.g. simplified capital market prospectus) have been reduced. Standards have also been introduced to ensure investor protection.

Keeping pace with global competition

A country's prosperity has long depended on its participation in the global economy and more recently on its integration into global value chains (GVCs). Countries and firms enter GVCs through foreign direct investment (FDI) and trade in goods and services that offer channels to access a broader portfolio of technologies, skills and knowledge-intensive assets. GVCs have changed the nature of global competition, as companies and countries no longer compete only for market share in high value-added industries, but also increasingly for high value-added activities within GVCs. GVCs also provide opportunities for internationalisation to new types of enterprises, including young innovative firms (see the policy profile "Attracting international science and technology investments by firms").

Box 4.2. **The rise of crowdfunding**

Estimates of the level of crowdfunding in North America, based on data from 1 250 active crowdfunding platforms, show that volumes increased by 145% between 2013 and 2014, to a total of approximately USD 9.5 billion. Europe enjoyed similar growth (+141%), but from a lower base, reaching a total of EUR 3.3 billion. Crowdfunding activities have boomed in Asia (+340%), totaling USD 3.4 billion in 2014, and the region is expected to drive future global expansion. Africa, Oceania and South-America have also registered notable progress, but the volumes were all below USD 100 million in 2015. Crowdfunding faces one limitation, however: for the time being, more than half of its transactions fund social or artistic causes and real estate activities, rather than broader for-profit businesses.

Crowdfunding platforms could also have a major impact on other funding channels, as they are more widely used to find investment opportunities and share risks (OECD, 2016h). For instance, business angel investors, who tend to invest more locally than venture capitalists, have the capacity to sponsor start-ups across a wider geographical area. The same platforms will also reinforce a growing trend among angel investors to co-invest with other early stage players, so as to diversify risk. Similarly non-equity crowdfunding (donation and reward-based) platforms create opportunities for innovators while creating low risks for backers, which have no financial interests attached to their contribution (OECD, 2015e).

Major regulatory challenges remain though (OECD, 2015e). Opportunities raised by crowdfunding should be examined together with risks, notably for investors, who may have uneven access to information and be less well-trained for such transactions than professional investors. The question should also be raised what the (future) product or "community benefits" are. Given the potential for early stage funding of start-ups, a clear regulatory framework is necessary to minimise such risks and foster the potential of crowdfunding (Wilson and Testoni, 2014 cited in OECD, 2015e).

Sources: Massolution (2015), *2015CF Crowdfunding Industry Report*, *http://reports.crowdsourcing.org/?route=product/product&product_id=54*; OECD (2016h), *Financing SMs and Entrepreneurs 2016: An OECD Scoreboard*, *http://dx.doi.org/10.1787/fin_sme_ent-2016-en*; OECD (2015e), *OECD Digital Economy Outlook 2015*, *http://dx.doi.org/10.1787/9789264232440-en*.

Many countries have recently refurbished their policy portfolio to assist SMEs and start-ups in accessing global markets. Most initiatives have focused on providing such firms with marketing intelligence and assistance for commercialisation, promotion and branding (Czech Republic, France, Iceland, Italy, Korea, Spain, Turkey and the United Kingdom). Governments also offer access to risk finance and loan guarantees (France, Malaysia), access to one-stop-shops for information and expert advice (Korea, Spain and the United Kingdom), support for finding international partnerships (United Kingdom), and training to gain skills and knowledge on international markets (Iceland). Slovenia is running a full programme of assistance and, along similar lines, Austria, Korea and Turkey have created global incubators and accelerators.

Financial support has also been granted to encourage the participation of small firms in international market-oriented R&D projects (Austria, Canada, Chile, Lithuania, Spain, Turkey and at the EU level) or to help them bridge the financial gap in order to enter markets abroad (Canada, Ireland), e.g. through internationalisation vouchers (Austria, Italy and Portugal). The budget of the European Eurostars Joint Programme of Horizon 2020 (2014-20) has been significantly increased with a view to promoting market-oriented transnational research activities involving SMEs. Costa Rica delivers innovation and sector-based grants with a certification for participation in GVCs.

Governance arrangements have also been revised for that purpose. France has merged existing promotion agencies into the new Business France that will assume a central function of communication and aim to strengthen the attractiveness and the brand image of the country. Germany has released its International Cooperation Action Plan that aims to give a ministry-wide perspective to the planning and implementation of its international co-operation activities, including international monitoring and evaluation. The Action Plan mobilises a broad variety of instruments, from mobility schemes to strategic alliances and partnerships.

The internationalisation of clusters is another key channel for SMEs to connect to global knowledge networks, and this has received particular policy attention (see the policy profile "Cluster policy and smart specialisation"). The specialisation and internationalisation of clusters have been fostered by deeper globalisation and growing competition and, as finance remains limited, governments have refocused policy action on areas with high potential for positive spillovers.

In addition, national guidance documents and action plans for STI have strengthened the attention given to internationalisation (Australia, Germany and Hungary). For example, a major priority of the newly revised German High-Tech Strategy is the integration of firms and science into global knowledge flows. This Strategy has also set up a new funding programme for the "Internationalisation of Leading-Edge Clusters". The Baltic Sea Region (BSR) Stars programme (2015-17), mentioned below, aims to initiate and enhance transnational co-operation between Denmark, Sweden, Norway, Finland, Germany, Lithuania, Estonia, Latvia, Poland and Iceland by linking cluster organisations. Recently, Australia, Belgium (Flanders), Croatia, Poland, Portugal, Slovenia and Turkey have revised their cluster policies or introduced cluster support programmes to promote the internationalisation of key clusters and improve capabilities to engage in international markets and global supply chains. The Global Centres of Expertise programme is a part of the Norwegian Innovation Clusters programme and directed at mature clusters with a global position. Its objective is to improve the clusters' competitive position, *inter alia* their attractiveness within GVCs.

4.4. Reorienting public research

Rationalising public research spending and accelerating knowledge transfer

Universities and public research has also been an important area of policy change (Figure 4.3). Some countries are now reviewing their overall research policy with the common goal of improving public funding efficiency, but using diversified approaches (see the policy profile "Financing public research"). For some years there has been a clear global trend towards more competitive funding approaches, with the introduction of performance-based elements in core institutional funding and a move towards more contractual arrangements (OECD, 2014b). This trend has been reinforced since 2014 in Austria, Canada, Greece, Ireland, Italy, New Zealand, Turkey and Central and Eastern Europe (Estonia, Poland). However, a reverse trend towards increased block funding has also been observed in a small number of countries, particularly in northern Europe.

A number of factors are pushing countries to prioritise and concentrate their financial contributions to public research, including progress in scientific research and the consequent opening up of new opportunities, intensifying global competition for talent and resources and scarcer public resources. In that respect, the recent financing conditions of public research are particularly worrying. Public R&D budgets are levelling off, or have

started to recede in many countries where governments are the main funders of public research (OECD, 2014a). The United States, the world's largest public research system, has recorded the longest multi-year decline in federal funding for academic R&D since the early 1970s (NSF, 2015). In addition, long-term international trends indicate that public R&D budgets are likely to plateau around current ratios (see Chapter 3). Unless strong economic growth drives a recovery in government spending, the amount of public money made available to public research is likely to increase only slowly. Competing policy priorities, such as the growing focus – and funding – given to business innovation and R&D tax incentives, could put public R&D budgets under further pressure. It is also likely that the decline of governments' support to universities and higher education institutions may have negative impact on the quality and inclusiveness of education systems due to subsequent cuts in educational services and increases in tuition fees.

Policy makers face the continuous conundrum of balancing resource distribution between different fields of science, long-term and short-term needs, big science and individual investigators, infrastructure and personnel, and national and international needs (see the policy profile "Public research missions and orientation"). Latvia is undertaking structural reforms so as to increase its institutional research capacity, while Turkey has launched an evaluation of the country's research infrastructure in order to enhance its efficiency. Peru has adopted the Innovate Perú Plan, which manages national STI budgets and places emphasis on the training of highly specialised human resources.

Recently, many countries have readjusted their strategic priority research areas with a view to tackling societal challenges (Australia, Belgium-Flanders, Denmark, Italy and Norway). China's 13th Five-Year Plan (2016-20) aims to double the proportion of funding dedicated to basic research (to 10%), and Korea has the ambition to raise the share of public research spending granted to basic research to 40% by 2017. The Netherlands has increased its budget for fundamental research as well. France has raised the relative contribution of its National Research Agency to generic programmes. Denmark has simplified its research funding system by merging former institutions into the Innovation Fund, which will support projects throughout the entire value chain from strategic research to commercialisation.

The sources of public research funding have also changed as a result of greater involvement by industry, for example, in Germany, Ireland, Italy and Luxembourg. This is due to higher investment incentives and reduced government budgets in certain countries, as well as a better alignment of the public research agenda with societal needs. In that respect, and as mentioned above, tax incentives for R&D are increasingly used to leverage private funding for public research (Iceland, Italy). Other instruments include new governance arrangements (e.g. Belgium's ministerial overhaul of economic affairs and science, Hungary's new higher education strategy, and Iceland's S&T Policy and Action Plan), new legal frameworks (Greece), innovation vouchers (Czech Republic, Portugal), a requirement for minimum co-financing in public support programmes (Latvia, Netherlands) and revised block funding allocation mechanisms to incentivise third-party funding (Norway). Ireland operates the Spokes programme, which offers extra funding to existing research centres for publicly funded projects so long as they involve industry partners.

Public-private partnerships (PPPs) offer opportunities for sharing risks, resources and orientation. PPPs are encouraged through funding consortia (e.g. Ireland, Peru and Spain) and joint research initiatives/centres. Sweden and the United Kingdom have recently injected

research capital, USD 35 million and USD 725 million respectively, into large-scale strategic partnership initiatives with the potential to raise an equivalent amount of private funding. At the EU level, new PPPs include the long-term Joint Technology Initiatives (JTIs), which are expected to receive USD 12 billion from the private sector over the next seven years.

Philanthropic and private science foundations, although still small and marginal, are playing an increasingly important role in complementing public funding, especially in fundamental translational research and in selected research areas (e.g. health and well-being). Norway and Portugal have recently reintroduced or reinforced their donation support scheme. Spain has set up the Council of Foundations for Science to disseminate information on best practices for promoting investment in science and to engage other foundations in science. Australia has set up the Biomedical Translation Fund (BTF) with USD 174 million PPP (AUD 250 million), with a view to stimulating private sector investment and accelerating the translation of Australia's medical discoveries into health applications.

Countries have continued to introduce legislation and develop national strategies to further promote both the commercialisation of R&D and collaboration between academia and industry (Korea, Turkey). National directives are also directly embedded in wider STI strategies (Denmark, Ireland), including smart specialisation strategies (Croatia, France, Greece, Latvia, Lithuania and Portugal). Colombia, Croatia, the Netherlands, Norway and Slovenia are continuing to professionalise technology transfer offices. National technology platforms and hubs have sprung up in many countries, acting as physical and virtual spaces for businesses and public research institutes to connect and access resources, skills and technical assistance. At an international level, the above-mentioned Baltic BSR Stars Project (2015-17) aims to create strong linkages between research environments, clusters and SME networks across countries in that region. Governments have also introduced technology transfer programmes (Germany, Lithuania), technology holdings (Korea) and accelerators (Turkey) to help bring the outcomes of public research to market.

Enabling interdisciplinary research and open science

Complex global societal challenges require research that combines traditionally distant academic fields, whereas public research organisations (universities and public institutes), research funding organisations and evaluation arrangements (particularly peer review) are overwhelmingly organised along disciplinary lines. The possibility of lowering disciplinary barriers has attracted considerable policy attention over recent decades, and this is reflected in a restructuring of some research agencies and actors (Belgium, Japan, Korea, Netherlands, Sweden and the United Kingdom) and changing evaluation and selection practices (Iceland, Italy and Norway).

Initiatives to support open science are gathering pace through greater access to research results and data, including scientific publications (see the policy profile "Open science"). Most recent efforts have focused on creating enabling legal frameworks and providing policy guidance for open access and open data. The number of countries with mandatory open access provisions is increasing. In most cases, the lead is being taken by research funding agencies, but these mandates can also be embedded in legislation at national (e.g. Mexico) or federal (e.g. Germany) levels. Austria, Germany and the United Kingdom have recently amended their national copyright legislation to promote open science. Appropriate infrastructures have also been built, especially to support the sharing of research data. The planning and funding of major e-infrastructures are increasingly

embedded in broader national (and European) procedures to map and fund research infrastructure. Finland, the United Kingdom and the United States have also started addressing the skills gap related to open science and big data analytics by promoting specific training and providing researchers with guidelines.

4.5. Broadening the skills and culture for innovation

Recently, several countries have renewed their policy portfolio with a view to strengthening innovation skills and building a broader science and innovation culture. These have actually been among the most active policy areas in the overall policy mix for innovation (Figure 4.3).

Expanding education in science, technology, engineering and mathematics (STEM) remains foundational for many OECD countries and partner economies. Public budgets to boost STEM education have been increased in Belgium (Federal), Croatia, Latvia, South Africa and the United States. Other recent policy initiatives include attempts to make STEM subjects more interesting and attractive to young people (Ireland, New Zealand and Portugal), new training programmes and recruitment criteria for teachers (Croatia, Korea, Ireland, Norway and Sweden), and new teaching methods and IT-based pedagogical tools (Czech Republic, Ireland, Lithuania, Portugal and Spain) (see the policy profile "Strengthening education and skills for innovation").

Education policy has also increasingly evolved to reflect the wider range of non-science-and-technology (S&T) skills required to innovate. Curricula have been revised to develop generic skills (Spain), problem-solving capacity (Korea) and entrepreneurial behaviours (Croatia, Ireland, Russia and Turkey). In Finland, entrepreneurship is linked to participatory, active citizenship and constitutes a cross-curricular theme at basic and upper secondary levels of education.

Many countries have also sought to reinforce public participation in and support for science and entrepreneurship. This has been a key component of national STI strategies in middle-income economies (Colombia, Chile, Costa Rica and Malaysia). But the same is true for some more advanced economies with traditionally high performance on STI indicators (Finland, Korea). There have also been efforts to build capacity for an S&T culture and the popularisation of science, e.g. communication events, museums and Internet-based resources (Czech Republic, France and the Russian Federation). Many new initiatives include large public events (Croatia, Australia, Greece and Korea), promotion campaigns (Chile), competitions and awards (Australia, Canada, China and Costa Rica). Greater policy attention has also been paid to fostering an entrepreneurial spirit and broadening the forms of creativity, with intervention extended to workplaces (see the policy profile "Building a science and innovation culture").

4.6. Improving policy governance

Towards more evidence-based policies

STI policy evaluation and impact assessment have gained more policy attention in recent years (see Figure 4.3 and the policy profile "Evaluation and impact assessment of STI policies"). This increased attention has been driven in part by growing fiscal constraints and the increasing need to demonstrate value for public money. Evaluation practices are very country-specific and path-dependent. This explains the persisting strong heterogeneity in the nature and level of development of evaluation and impact assessment among countries,

as well as the slow pace of change. Some countries have evaluation and impact assessment capabilities that are still at an early stage of development (e.g. Colombia, Malaysia, Russian Federation and South Africa) (OECD, 2016i; 2016j), while in others evaluation and impact assessment are part of the policy culture and are institutionalised to a greater extent.

Recent trends in policy evaluation include the more intensive use of public administrative data and online technology for collecting data ("big data"), smaller and quicker exercises (New Zealand), more strategic use of evaluations (China) and the increasing complexity of the concepts and practices employed, which is often related to the multiplication of rationales, strategic objectives, actors, arrangements, targets and instruments.

The complexification of the portfolio of STI policies (more instruments, goals, actors) has increased the risk that public resources might be misallocated and raised the issue of a possible negative interaction between different policy measures. In response, systemic evaluations have spread globally, albeit in different ways according to the countries concerned. Colombia, Iceland, Lithuania, Luxembourg, Malaysia, Spain, Sweden and Thailand have recently undergone large-scale peer-review evaluation exercises conducted by international organisations, including the OECD. The European Union has conducted an evaluation of its Seventh Framework Programme and an interim evaluation of Horizon 2020 (EC, 2013). Some countries have mobilised national evaluation capacity to assess policy outcomes (e.g. China's S&T Development Plan, Estonia's R&D Strategy "Knowledge-Based Estonia"), sometimes focusing on parts of the national STI system (e.g. Ireland on its support system for enterprises, the Netherlands on its enterprise policy and Australia on its research system).

Overall, efforts have been directed towards building the knowledge base for STI policy, e.g. through the development of impact assessment studies and the systematisation of evaluation, the implementation of a whole-of-government approach to evaluation (e.g. the UK Treasury has set an evaluation framework to compare investment spending across areas of government), more harmonised practices (common methodologies and indicators) and the creation of data infrastructures and expert communities (OECD, 2012). Japan, Norway and the United States have been particularly active at setting up science of science and innovation policy (SciSIP) initiatives to develop models, analytical tools, data and metrics. The European Commission (Policy Support Facility) and the OECD/World Bank (Innovation Policy Platform) maintain web-based platforms that provide one-stop shop access to repositories of internationally gathered knowledge on innovation and policies, as well as tools for benchmarking and diagnostics (IPP, 2016).

Towards more responsible STI policies

Governments have paid attention to fostering a comprehensive approach to governance by enhancing co-ordination arrangements across the board (Austria, Colombia and Ireland) and involving industry and society upstream in the policy debate through participatory approaches to setting priorities (Argentina, Chile, Denmark, Greece, Netherlands and Turkey) (see the policy profile "Public engagement in STI policy").

While much STI policy attention is currently focused on the economic slowdown, governments also face unprecedented and increasingly pressing societal challenges. In the Daejeon Declaration on STI Policies for the Global and Digital Age (2015), ministers across a large number of OECD and non-OECD economies highlighted the essential role of STI in

meeting global and societal challenges, such as environmental sustainability, food security and healthy ageing, and in achieving the Sustainable Development Goals agreed by the United Nations. As concerns have mounted, the ethical and societal dimensions of research have come to the fore and are increasingly reflected in the framing of more "responsible research and innovation" (RRI) policies. The RRI policy mix is complex, as multiple policy instruments should be mobilised at various stages of the policy cycle to achieve multiple strategic objectives. In practice, most recent policy efforts have tried to foster a comprehensive approach to governance, to define new national guidelines and orientation, to provide infrastructures and incentives for interdisciplinary research and open science, and to broaden the range of skills as well as the culture for innovation (see the policy profiles "Public engagement in STI policy" and "Building a science and innovation culture").

RRI principles have been integrated into the general formulation of innovation policy agendas (see the policy profile "National strategies for science, technology and innovation"). The EU Horizon 2020 research programme strongly focuses on societal challenges and acts as a federator for matching national strategies in several European countries (EC, 2013). Beyond the EU area, Japan has launched its 5th S&T Plan (2016-20), which aims to achieve sustainable growth and contribute to solving global problems. National foresight and technology assessment exercises anticipating long-term societal needs have helped inform policy formulation in the Czech Republic and Germany.

More downstream RRI policy initiatives are targeting the organisations in charge of policy delivery (e.g. funding agencies) (Norway, Peru). RRI principles are also sometimes mainstreamed in existing funding programmes, e.g. by increasing the share of funding for interdisciplinary research, by introducing gender considerations into the process of allocating funding (Ireland), by targeting the social sciences and humanities (Germany), and through new specific research funding (e.g. Austria's Top Citizen Science programme).

Notes

1. It is noteworthy mentioning that the exploitation of the STIP survey in a semi-quantitative approach for developing policy indicators is in progress. Further exploration is required as to better identify and assess possibilities and limitations in use and interpretation (Kergroach, forthcoming-b). Yet, some simple remarks could be made from a descriptive analysis of the STIP database.
2. This section is abridged from the *OECD Economic Outlook 2016*, otherwise references are stated.
3. The unit of observation of the STIP mapping is the "major policy initiative" that is defined as a public action that i) aims to achieve one or several public policy goals in the policy area of science, technology and innovation; ii) is expected to modify the behaviours of actors and stakeholders, being national, domestic or foreign, who are part of or influential on, the national innovation systems; and iii) is implemented with a minimum time horizon or on a continuous basis (i.e. not as a one-off "event"). The level of observation is national, central or federal, according to countries' specificities in governance arrangements. A policy initiative deserves a single (or multiple) policy goal(s). A policy initiative has several properties. Each policy initiative aims to achieve a single (or multiple) strategic objective(s), make use of a single (or multiple) policy instrument(s), is generic or targeted if it addresses a single (or multiple) target population(s) and/or a single (or multiple) sector(s) and/or technology(ies). A policy initiative also presents several characteristics in terms of the directionality of policy intervention (demand- or supply-side, top-down or bottom-up), and policy implementation (competitive or universal, selective or discretionary). It is worth noting that the characteristics of a policy initiative are also intrinsically linked to its strategic objectives, instruments and targets. The policy mix can therefore be described in terms of the relative articulation of these initiatives and their properties (Kergroach, S. et al., forthcoming-a).
4. Although they imply a fiscal cost due to foregone revenues, tax incentives for R&D represent in relative terms a small amount of public money compared to total taxes on corporate income and profits. R&D tax concessions accounted on average in 2014 for 4% – or less – of corporate income

taxes collected by central governments in most countries and less than 12% in the countries that have the most generous tax schemes for R&D in place (author's calculations based on OECD 2016b and 2016g).

5. Knowledge-based capital (KBC), also referred to as "intangible assets" or "intellectual capital", constitutes a long-lasting resource for companies and institutions. KBC assets are not physical in nature, and their main value stems from their knowledge content and their ability to add value to other assets. Investment in KBC can be subdivided into three main groups: computerised information (e.g. software and databases); innovative property (e.g. scientific and non-scientific R&D, copyrights, designs and trademarks); and economic competencies (e.g. brand equity, advertising and marketing, firm-specific human capital, and organisational know-how and capabilities). Some KBC types are now included in the System of National Accounts (SNA). These include: software, R&D, entertainment, literary and artistic originals, and mineral exploration. Other KBC assets, such as design, new product development in the financial industry, brands, firm-specific training and organisational capital, are the subject of methodological work aimed at measuring them in an internationally comparable way (OECD, 2015a).

References

Appelt, S., M. Bajgar, C. Criscuolo and F. Galindo-Rueda (forthcoming), "R&D tax incentives: evidence on design, incidence and impacts", *OECD Science, Technology and Industry Policy Papers*, OECD Publishing, Paris.

EBAN (European Business Angels Network) (2016), The European Trade Association for Business Angels, Seed Funds, and other Early Stage Market Players, Statistics online, May, *www.eban.org/wp-content/uploads/2014/09/Early-Stage-Market-Investment-2015.png*.

EC (European Commission) (2013), *Horizon 2020: The EU Framework Programme for Research and Innovation*, *http://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation*.

EC/OECD (forthcoming), *International Database on STI Policies (OECD STI Outlook)*, edition 2016, *www.innovationpolicyplatform.org/sti-policy-database*.

ECB (European Central Bank)(2016), *Survey on the Access to Finance of Enterprises (SAFE)*, April, *www.ecb.europa.eu/stats/money/surveys/sme/html/index.en.html*.

European Strategy and Policy Analysis System (ESPAS) (2015), "Global Trends to 2030: Can the EU meet the challenges ahead?", *http://europa.eu/espas/pdf/espas-report-2015.pdf*.

IMF (International Monetary Fund) (2016), *World Economic Outlook*, April, *www.imf.org/external/datamapper/index.php*.

IPP (Innovation Policy Platform)(2016), *www.innovationpolicyplatform.org*.

IPP.Stat (2016), IPP Statistical Platform IPP.Stat, January, *www.innovationpolicyplatform.org/content/statistics-ipp*.

Kergroach, S., J. Chicot, C. Petroli, J. Pruess, C. van OOijen, N. Ono, I. Perianez-Forte, T. Watanabe, S. Fraccola and B. Serve, (forthcoming-a), "Mapping the policy mix for innovation: the OECD STI Outlook and the EC/OECD International STIP Database", *OECD Directorate for Science, Technology and Innovation Working Papers*, OECD Publishing, Paris.

Kergroach, S., J. Pruess, S. Fraccola and B. Serve (forthcoming-b), "Measuring some aspects of the policy mix: exploring the EC/OECD International STI Policy Database for policy indicators", *OECD Directorate for Science, Technology and Innovation Working Papers*, OECD Publishing, Paris.

KPMG (2015), "International Tax, Patent Boxes, and Tax Reform", September, *https://home.kpmg.com/content/dam/kpmg/pdf/2015/10/tnf-combined-sep11-2015.pdf* (accessed 24 September 2016).

Massolution (2015), *2015CF Crowdfunding Industry Report*, *http://reports.crowdsourcing.org/?route=product/product&product_id=54*.

NSF (National Science Foundation) (2015), NSF's Higher Education Research and Development (HERD) Survey, November, *www.nsf.gov/statistics/2016/nsf16302/* (accessed 24 September 2016).

OECD (2016a), *OECD Economic Outlook*, no. 99, Vol. 2016, Issue 1, June, *http://dx.doi.org/10.1787/9572784d-en*.

OECD (2016b), *OECD National Accounts Database*, June. Data extracted from OECD.Stat on 02 June 2016.

OECD (2016c), *OECD Productivity Database*, *www.oecd.org/std/productivity-stats*.

OECD (2016d), *Research and Development Statistics (RDS) Database*, March, *www.oecd.org/sti/rds*.

OECD (2016e), *OECD Main Science, Technology Indicators (MSTI) Database*, *www.oecd.org/sti/msti*.

OECD (2016f forthcoming), *OECD National Accounts at a Glance*, OECD Publishing, Paris.

OECD (2016g), *OECD-NESTI Data Collection on R&D Tax Incentives*, July, *www.oecd.org/sti/rd-tax-stats.htm*.

OECD (2016h), *Financing SMEs and Entrepreneurs 2016: An OECD Scoreboard*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/fin_sme_ent-2016-en*.

OECD (2016i), *OECD Reviews of Innovation Policy: Malaysia 2016*, OECD Publishing, Paris. *http://dx.doi.org/10.1787/9789264255340-en*.

OECD (2016j), *OECD Reviews of Innovation Policy*, *www.oecd.org/sti/inno/oecdreviewsofinnovationpolicy.htm*.

OECD (2015a), *OECD Science, Technology and Industry Scoreboard*, OECD Publishing, Paris, *www.oecd.org/sti/scoreboard*.

OECD (2015b), *The Future of Productivity*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264248533-en*.

OECD (2015c), *Entrepreneurship at a Glance 2015*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/entrepreneur_aag-2015-en*.

OECD (2015d), *Government at a Glance 2015*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/gov_glance-2015-en*.

OECD (2015e), *OECD Digital Economy Outlook 2015*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264232440-en*.

OECD (2014a), *OECD Science, Technology and Industry Outlook 2014*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/sti_outlook-2014-en*.

OECD (2014b), *Promoting Research Excellence: New Approaches to Funding*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264207462-en*.

OECD (2012), *OECD Science, Technology and Industry Outlook 2012*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/sti_outlook-2012-en*.

OECD (2011), *Financing High-Growth Firms: The Role of Angel Investors*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/9789264118782-en*.

OECD (2010), *OECD Science, Technology and Industry Outlook 2010*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/sti_outlook-2010-en*.

OECD (2009), "Policy responses to the economic crisis: Investing in innovation for long-term growth", *OECD Policy Brief*, Paris, June, *www.oecd.org/sti/42983414.pdf* (accessed 24 September 2016).

OECD (2002), *Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264199040-en. Updated in 2015, available at *http://dx.doi.org/10.1787/9789264239012-en*.

Wilson, K. and M. Testoni (2014), "Improving the role of equity crowdfunding in Europe's capital markets", *Bruegel Policy Contribution Issue*, 2014/09.