

The Innovation Imperative

Contributing to Productivity, Growth and Well-being

“You can see it everywhere but in the productivity statistics.” Robert Solow’s 1987 quip¹ on the effects of the computer age might apply just as well to innovation: however central it may be to advanced and emerging economies and societies, its impact is not so easy to quantify.

Nevertheless, innovation is a key driver of productivity, growth and well-being, and plays an important role in helping address core public policy challenges like health, the environment, food security, education and public sector efficiency. Innovation-led productivity growth will become even more important in the future to address key challenges like ageing populations and climate change.

But seizing innovation’s potential, actually turning it into growth and jobs, improved well-being and health outcomes, or solutions to problems like climate change remains a challenge for many countries. To harness its contribution, policy makers need to foster a sound environment for innovation, invest in the foundations, such as research, education and knowledge infrastructure, and address critical barriers to innovation.

The quick read

Policy makers can do better in marshalling the power of innovation to help achieve core objectives of public policy. Strong leadership at the highest political levels will be essential.

There is no silver bullet: policy makers will require a mix of *policies for innovation*, which will vary depending on the context, and that go beyond narrowly defined research and innovation policies.

Concentrating policies on **five concrete areas for action** will help governments foster more innovative, productive and prosperous societies, increase well-being, and strengthen the global economy in the process:

Effective skills strategies: Innovation rests on people that have the knowledge and skills to generate new ideas and technologies, bring them to the market, and implement them in the workplace, and that are able to adapt to structural changes across society. But two out of three workers do not have the skills to succeed in a technology-rich environment. A broad and inclusive education and skills strategy is therefore essential.

A *sound, open and competitive business environment* that encourages investment in technology and in knowledge-based capital, that enables innovative firms to experiment with new ideas, technologies and business models, and that helps successful firms to grow and reach scale. Policy should avoid favouring incumbents as this reduces experimentation, delays the exit of less productive firms and slows the reallocation of resources from less to more innovative firms.



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Sustained public investment in an efficient system of knowledge creation and diffusion: Most of the key technologies in use today, including the Internet and genomics, have their roots in public research, illustrating how essential public investments are. At a time when the world economy faces many long-term challenges, public investment needs to focus on durable benefits, rather than short-term outcomes. Support for business innovation should be well balanced and not overly rely on tax incentives. Well-designed, competitive grants need to complement tax incentives, can be better suited to the needs of young innovative firms, and can also be focused on areas that have the highest impact.

Increased access and participation in the digital economy: Digital technologies offer a large potential for innovation, growth and greater well-being. However, policy action is needed to preserve the open Internet, address privacy and security concerns, and ensure access and competition. Digitally enabled innovation also requires investment in new infrastructure such as broadband, but also in ensuring we have enough spectrum and Internet addresses for the future.

Sound governance and implementation: The impact of policies for innovation depends heavily on their governance and implementation, including trust in government action and the commitment to learn from experience. Policy learning rests on a well-developed institutional framework, strong capabilities for evaluation and monitoring, the application of identified good practices, and an efficient, capable and innovative public sector.

Innovation today

Empirical analysis shows that innovation, in its various forms, can account for a substantial share of economic growth – often around 50% of total GDP growth – depending on the country, the level of economic development and the phase of the economic cycle. Harnessing innovation requires policies that reflect the realities of innovation as it occurs today. Some of the main features of innovation today include:

- A scope that goes beyond science and technology, involving investments in a wide range of knowledge-based assets. Social and organisational innovations, including new business models, are increasingly important to complement technological innovation.
- Involvement of a wide and expanding range of actors, including firms, entrepreneurs, foundations and non-profit organisations, universities, scientific institutes, public sector agencies, citizens and consumers, often working in close collaboration.
- A strong and ever-expanding basis in the digital economy, facilitated by the growth of mobile telecommunications, the convergence of voice, video and data to the Internet and the rapid uptake of data and sensors (the Internet of Things), in both advanced and emerging economies.
- A growing role of emerging economies, in particular China, which recently passed the European Union in becoming the second largest funder of R&D, behind the United States.
- An increasingly global context, with innovation drawing on knowledge and ideas from across the world, though still often rooted in unique local and regional strengths. Production is increasingly occurring in value chains where both production and innovation are fragmented across countries.
- The emergence of a “next production revolution”, which will lead to transformations in the nature of production, in the jobs associated with production, in the location of those jobs, in environmental impacts, and in the respective roles of manufacturing and services.
- Growing demands on innovation, not only to support growth and job creation, and the efficient delivery of public services, but also to address specific social and global challenges, including green growth, health, food security and the fight against poverty.

Policies for innovation

Policies for innovation are much broader than innovation policies – measures to support business R&D, financing for risk capital, etc. Policies for innovation need to be focused on enhancing the performance of the system as a whole. In any given country, the priority assigned to different policies will depend on the nature and state of the system of innovation: one size does not fit all. OECD analysis suggests that innovation requires action in five important areas.

1. Effective skills strategies to foster talent and skills and optimise their use

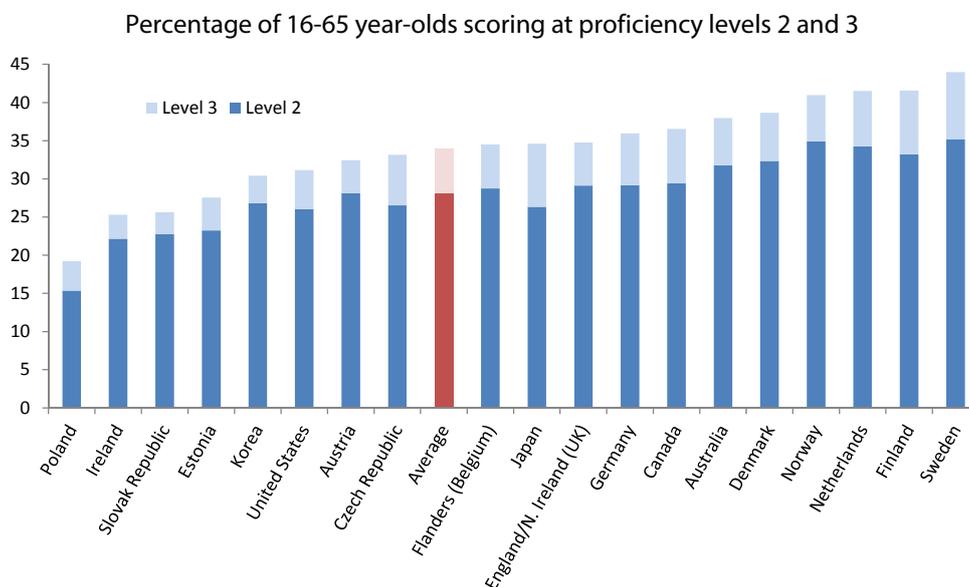
Education and training systems are core to innovation and productivity. But OECD assessments show that on average, only one-third of all adults have the skills necessary for a technology-rich environment (Figure 1). Beyond subject-specific expertise, education should also develop students' creativity, critical thinking, entrepreneurship and communication skills. Doing so ultimately depends on pedagogical approaches and the design of curricula. Many disciplines are relevant. A key principle should be the creation of an environment that enables individuals to choose and acquire appropriate skills and supports the optimal use of these skills at work. The OECD's 2013 *Skills Strategy* sets out a comprehensive approach to develop skills and put them to best use.

In the workplace, possible policy avenues to support firm-level training include improving information about training opportunities, setting legal frameworks so that private parties can organise and finance their training (e.g. through contracts), and increasing the portability of skills by improving information on the competencies and skills that are gained through various learning channels. Reinforcing public funding of vocational education and training, and tax incentives to promote training, can be used as supplementary measures. However, policy measures must take into account the implications that the "poaching" of workers subsequent to training has for firms' willingness to undertake such investments.

On average across countries, roughly one-third of workers report a mismatch between their existing skills and those required for their job, implying they are either over- or under-skilled. This mismatch also represents a barrier to the growth of innovative firms. Making the most of the available skills in the economy requires reforms to policies that restrict worker mobility, and funding for lifelong learning.

Women must also have equal opportunities to contribute to innovation. Governments should strive to ensure that barriers to women's participation in science, innovation and entrepreneurship are removed. Gender stereotypes and non-transparent nomination and appointment procedures can all hinder female involvement. Showcasing successful women in science and technology, and in high-growth firms, can provide useful role models for young women who may not otherwise consider such fields. Removing gender biases and fostering the participation of women is not only important for equality, but can also improve research and innovation itself.

Figure 1. Proficiency in problem solving in technology-rich environments among adults



Source: OECD, Survey of Adult Skills (PIAAC) (2012), Table A2.10a.

Policy should also facilitate the development of linkages and networks among researchers and innovators across countries. The knowledge embodied in people is the object of strong global competition, but OECD research shows that knowledge flows across countries are circular. Policies should therefore not be based on a view that international mobility entails zero-sum competition. Collaboration between countries often results in better outcomes. A key consideration is that migration regimes for the highly skilled should be efficient, transparent and simple, enabling movement on a short-term basis.

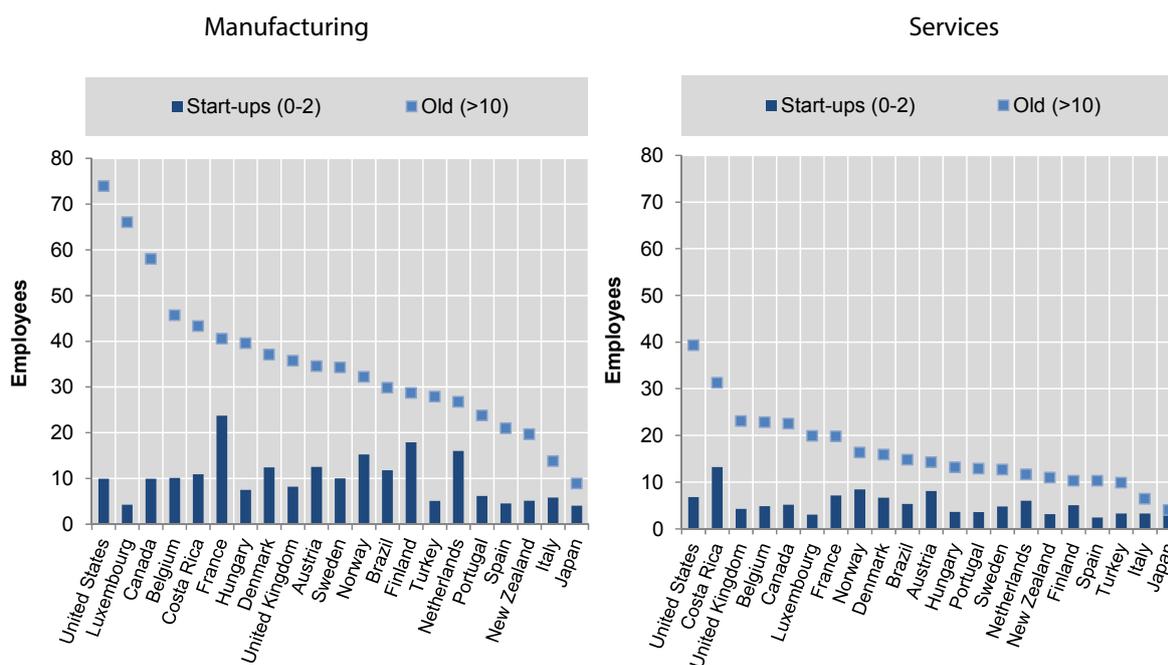
2. A business environment that supports investment and fosters dynamism

Strengthening investment is rightly a high priority for policy. But today in many OECD countries, firms invest as much in the knowledge-based capital (KBC) that drives innovation, such as software, databases, research and development, firm-specific skills and organisational capital, as they do in physical assets, such as machinery, equipment or buildings.

Structural reforms in product, labour, and financial markets are important to get the most out of investment in KBC. Such reforms can help capital and labour flow to their most productive uses, which are often in KBC-intensive activities. Reforms can also help firms achieve sufficient scale, which is important in entering international markets (Figure 2). Policy reforms, can also avoid trapping resources in inefficient firms, e.g. bankruptcy laws that do not excessively penalise failure. Open markets and competition are particularly important to diffuse innovations, including to lagging firms. Rising participation in global value chains (GVCs) magnifies the benefits from lifting barriers to international trade and from easing services regulation, given the multiple crossing of borders involved in production and the increasing reliance of GVCs on domestic services.

Policies in OECD countries often implicitly or explicitly favour incumbents, and do not always enable the experimentation with new ideas, technologies and business models that underpins the success of innovative firms, be they large or small. Subsidies to incumbents and other policy measures that delay the exit of less productive firms can stifle competition and slow the reallocation of resources from less to more productive firms. Examples include fiscal measures that favour well-established firms – such as R&D tax credits which do not have carry-forward provisions.

Figure 2. The average size of start-ups and old firms



Note: The figure reports the average size of start-up firms (from 0 to 2 years old) and firms more than 10 years old, over the available years. See source for country-specific details.

Source: Criscuolo, Gal and Menon (2014) and OECD DynEmp Express Database, April 2015, www.oecd.org/sti/dynemp.htm.

Young firms are also important for innovation and play a key role in employment creation, accounting for over 45% of all new jobs created in OECD countries over the past decade. Even if only some of these firms reach scale, they help drive renewal and creative destruction in the economy and support the growth of new and emerging areas. However, the average young firm does not scale very well in many OECD countries (Figure 2), and their small size limits their impact on innovation, the economy and society. Policies which (unwittingly) constrain the growth of firms should therefore be assessed with particular care. Examples include both regulations which only affect firms above a certain size, and also rewards, such as support mechanisms, for which only smaller firms are eligible.

The growing importance of business investment in KBC also highlights the need for sound framework policies in other areas. For example, firms today rely on a wide range of intellectual property rights (IPR) to protect their investments in KBC, but existing IPR policies are not always well suited to the fast-changing nature of innovation. Ensuring a well-functioning IPR system is therefore an important priority for policy.

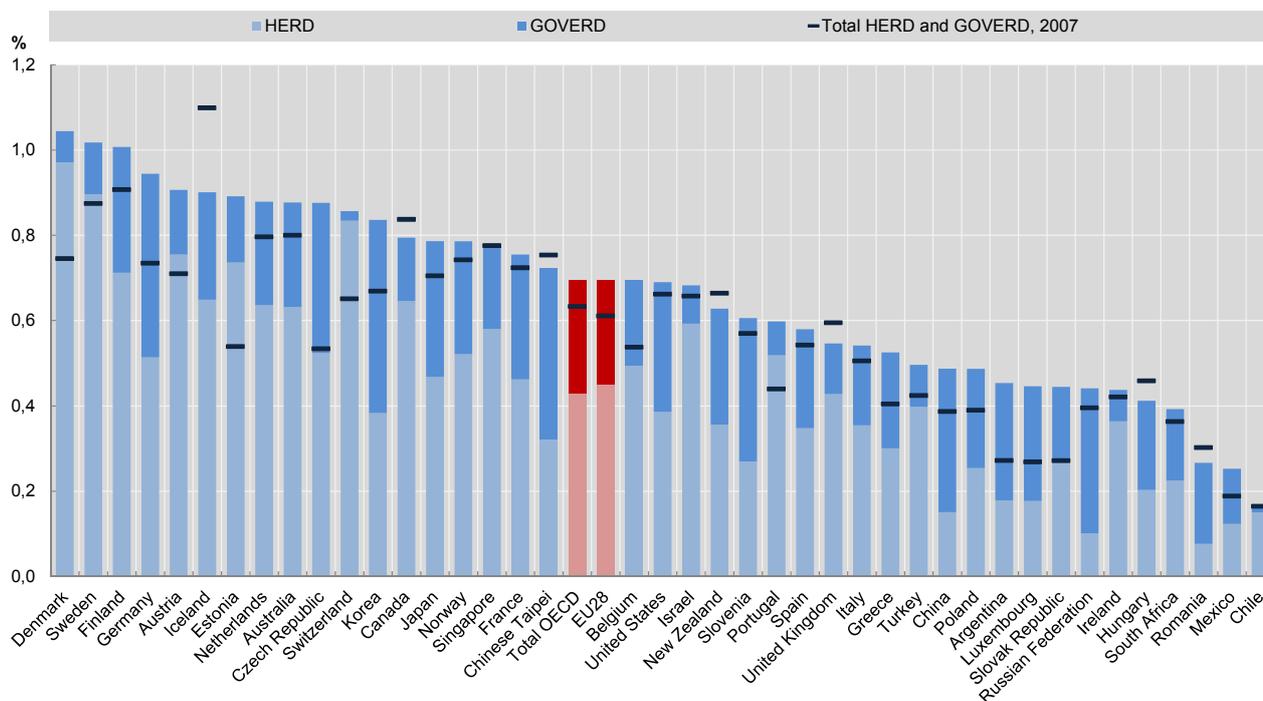
Access to finance is another important challenge for innovative enterprises. External financing is especially important when innovative firms, particularly young firms, begin to grow. Strengthening seed and early-stage equity finance, including venture capital and angel investment, can boost the creation and development of innovative ventures. Other mechanisms, such as public listings for SMEs, can provide financial resources for established growth-oriented firms. Along with efforts to boost the supply side of the equity market, demand-side initiatives – e.g. improving investment readiness and improving finance-related skills in new and small firms – should also receive policy attention. A further challenge in some countries is to properly design policies that lever private resources and help to share risk with the private sector (such as through co-investment schemes for financing seed and early-stage ventures).

3. Investment in an efficient system of knowledge creation and diffusion

Government plays a critical role in providing some of the foundations for innovation. Basic research, in particular, drives long-run productivity growth by enhancing the ability of economies to learn from innovations at the global frontier. Public funding is needed to address the inherent under-investment in basic research of private firms, linked to the large knowledge spillovers of such research. Long-term funding for curiosity-driven research must be preserved, as this has been the source of many significant innovations in the past and has high social returns, while project-based funding can allow for more direct steering of public research towards major public policy objectives, complementing private research spending. A long-term and stable perspective for public research funding is essential; focusing on short-term results will put the future seeds of innovation at risk. While public budgets for R&D have held up well since the crisis in most OECD countries (Figure 3), they are now declining in several.

Figure 3. Public expenditure by type of research system

Higher education expenditure on R&D (HERD) and government expenditure on R&D (GOVERD), as a percentage of GDP, 2013, and total HERD and GOVERD in 2007



Source: OECD Main Science and Technology Indicators Database, June 2015, www.oecd.org/sti/msti.

The broader system of knowledge creation and diffusion is equally important for productivity growth; more intensive collaboration between firms and universities is associated with more diffusion of foreign technologies. Policy makers should facilitate knowledge flows and encourage the development of networks and markets which enable collaboration and the efficient creation, circulation and diffusion of knowledge. Policies for commercialisation of public research should go beyond patents and licensing, however, and should also include public-private collaborative research, student and faculty mobility, contract research, faculty consulting and student entrepreneurship. A modern IPR system is important to foster knowledge creation and diffusion, as is a policy and regulatory environment that manages the risks associated with innovation and enables the responsible development of technologies and their convergence.

Rising international connectedness and the key role of multinational firms in driving frontier R&D imply that the benefits from public basic research and support to private R&D will become more widespread globally. This may weaken incentives for national governments to support these activities while at the same time pushing them to compete to attract mobile investments by MNEs. Thus, global cooperation on research – i.e. joint funding and mechanisms to facilitate cross-border and cross-field collaboration – will become increasingly important. Developing effective science and technology initiatives at the global level requires responsive and adaptable modes of governance, combined with flexible funding and spending mechanisms.

Governments continue to stimulate R&D either directly through contracts, grants and awards or indirectly through R&D tax credits. A focus on high social returns and international good practices is essential. R&D tax incentives should be designed to also meet the needs of young, innovative firms and avoid amplifying resource losses from cross-border tax planning. R&D tax incentives are often unsuitable for young firms, as they often not yet generated taxable income, and therefore cannot benefit, despite their particular strengths as R&D performers (e.g. in creating radical innovations) and job creators. Good design of tax credits through cash refunds, carry forwards, or other approaches can address this problem. Governments should also ensure that R&D tax incentives are predictable for firms, and avoid tinkering with them repeatedly to minimise policy uncertainty. Governments should systematically evaluate tax relief measures to assess whether their targeting and design remain appropriate.

Polymakers should also balance indirect support for business R&D (fiscal incentives) with direct support for innovation. Direct support measures – e.g. contracts, grants, awards for mission-oriented R&D or support for networks – can be particularly effective for young firms that lack the upfront funds or collateral to finance an innovative project. Any allocation of direct support should be competitive and based on objective and transparent criteria. Selection processes must be designed to ensure efficiency (including minimal bureaucracy), avoid rent-seeking (especially by vested interests) and support challengers (e.g. young firms). Non-financial support measures, e.g. training, mentoring and network development, including for SMEs, are an important component of the overall policy mix, as lack of funding is only one of the barriers that hold back innovation. Across all innovation policies, well-designed public-private partnerships are increasingly important to help lever government funding.

4. Access and participation in the digital economy

Almost no business today is run without the help of ICTs. In 2014, almost 95% of enterprises in the OECD area had a broadband connection. However, only 21% of firms in the OECD area conduct e-sales, and only 22% using cloud computing services (Figure 4). Overall, differences among countries in the use of various ICT technologies remain considerable. This is closely, but not exclusively, related to differences in the share of smaller firms across countries.

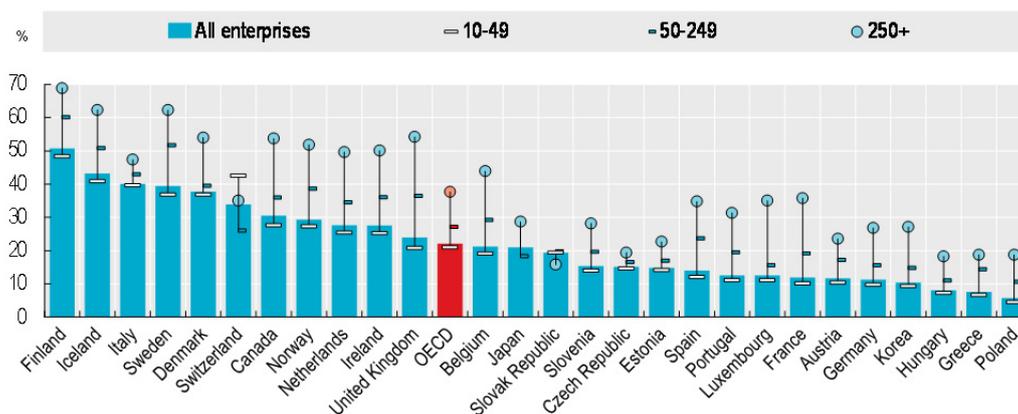
At the same time, the growing number of computer-mediated transactions and the accelerating migration of social and economic activities to the Internet are contributing to the generation of a huge volume of (digital) data – commonly referred to as “big data”. Big data are now used by organisations, often in highly creative ways, to generate innovations in products, processes, organisational methods and markets. However, the use of big data creates several for governments. Governments will need to foster investments in broadband, smart infrastructure and the Internet of Things as well as in data and analytics, with a strong focus on SMEs and high value-added services. Promoting skills and competences in data analytics is also important. Moreover, removing unnecessary barriers to the development of the Internet of Things, such as sector-specific regulations, can help ensure its impact across the economy.

An open and accessible Internet, with high fixed and mobile bandwidth, is essential for innovation in the 21st century. The Internet has become a platform for innovation thanks to its end-to-end connectivity and lack of gatekeepers, providing a place where creativity, the exchange of ideas, entrepreneurship and experimentation

can flourish. Furthermore, an open Internet enables the management of GVCs, in which companies increasingly spread production internationally. Governments need to strike the right balance between the social benefits of openness and private preferences for a less open system, however. It will be particularly important to preserve the open Internet and promote the free flow of data across the global ecosystem. At the same time, governments will need to address individuals' concerns about privacy violations and also promote a culture of digital risk management across society. Finally, to ensure the digital economy is inclusive, governments need to assess market concentration and address barriers to competition.

Figure 4. Enterprises using cloud computing services by size, 2014

As a percentage of enterprises in each employment size class



Source: OECD (2015), *Digital Economy Outlook 2015*, <http://dx.doi.org/10.1787/888933224863>.

5. Strong governance and implementation of policies for innovation

The governance and implementation of national innovation strategies are critical to their success. The process of developing a national strategy requires early and adequate involvement of stakeholders, including business, academia, social partners and other key actors. Because many policies affect innovation, it is important that they are well aligned, not only at central-government level, but also between the centre and regional and local authorities, many of which actively support innovation. The development and implementation of innovation policies also require strong capabilities within the public sector, including in building trust in government action and ensuring the support of stakeholders for policy actions.

The growing importance of governance also reflects a new approach to policies for innovation in many countries, where governments increasingly act as a facilitator in the face of complexity and uncertainty, enabling closer co-ordination between individual economic agents as well as fostering greater experimentation in the economy. This includes greater emphasis on building networks, improving co-ordination and regulation, as well as promoting awareness and less reliance on government funding.

Establishing a national strategy for innovation is one thing; its implementation is often another matter. The framing of policies for innovation needs to recognise that they operate in a complex, dynamic and uncertain environment, where government action will not always get it right. A commitment to monitoring and evaluation of policies, and to learning from experience and adjusting policies over time, can help ensure that government action is efficient and reaches its objectives at the least possible cost.

Policy learning rests on a well-developed institutional framework, strong capabilities for evaluation and monitoring, applying identified good practices, and an efficient government bureaucracy. Incorporating policy monitoring and evaluation at the design stage of policy making will support evidence-based decision making and accountability and enable policy learning over time, as can experimentation with policies at a small scale. Better measurement of innovation outcomes and impacts is essential in this context.

Note

1. Robert Solow, "We'd better watch out", *New York Times Book Review*, July 12, 1987, page 36.

Further reading

OECD (2013), *OECD Skills Strategy*, OECD Publishing, Paris, <http://skills.oecd.org/documents/oecdskillsstrategy.html>.

OECD (2015), *The Future of Productivity*, OECD Publishing, Paris. www.oecd.org/economy/the-future-of-productivity.htm.

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Directorate for Science, Technology and Innovation Policy Note

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