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**MINISTERIAL REPORT ON THE OECD INNOVATION STRATEGY:  
FOSTERING INNOVATION TO STRENGTHEN GROWTH AND ADDRESS GLOBAL AND SOCIAL  
CHALLENGES - KEY FINDINGS**

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**English - Or. English**

**MINISTERIAL REPORT ON THE OECD INNOVATION STRATEGY  
FOSTERING INNOVATION TO STRENGTHEN GROWTH AND ADDRESS GLOBAL AND  
SOCIAL CHALLENGES – EXECUTIVE SUMMARY**

**Innovation, now more than ever**

1. New sources of growth are urgently needed to help the world recover from the economic crisis and move towards a more sustainable growth path. Innovation – which involves both the creation and diffusion of products, process and methods – is a critical part of the solution. It provides the foundation for new industries, businesses and jobs. Innovation-led growth can also provide the “head room” that will make it easier for governments to address pressing social and global challenges, including climate change. Moreover, it can do much to help address these challenges at the lowest cost. While not a solution to all the world’s ills, innovation is an important tool that can and should be better utilised.

2. Innovation is already a central element of the economy; in many OECD countries, firms invest as much in the intangible assets that drive innovation, such as R&D, software, databases and skills, as they do in physical capital, such as machinery, equipment or buildings. Such investment accounted for up to 1 percentage point – or around one-quarter – of labour productivity growth in Austria, Finland, Sweden, the United Kingdom and the United States between 1995 and 2006 (Figure 1). Innovation is also essential for emerging economies as they seek to enhance their competitiveness, diversify their economy and move towards activities with more high value added.

**Strengthening innovation in a time of fiscal consolidation**

3. Many of the recent stimulus packages have recognised the importance of innovation as a driver of growth. Governments understand that public investment in education, knowledge infrastructure and research is fundamental to growth and provides the seeds for future innovation. While cuts in such spending may provide short-term fiscal relief when times are difficult, growth will suffer in the long term. Strengthening innovation requires a stable, long-term policy commitment.

4. Many countries have much scope to make government policies in support of innovation more efficient and to innovate in the delivery of public services. In some countries, this calls for rationalisation and the simplification of a multitude of innovation support policies. In others, reforms to encourage excellence and efficiency in education and training systems and public research institutions can help increase the returns from public investment. Much can be done to strengthen innovation and growth by removing regulatory barriers to innovation and entrepreneurship, including administrative regulations, and by implementing pro-growth tax policies.

5. Current policies to strengthen innovation largely focus on the supply of knowledge and inventions through investment in basic R&D and support for private-sector R&D (Figure 7). These policies are important, but attention also needs to be given to increasing the uptake of innovation by society and channelling it towards areas of greatest need. Such policies need not be costly; they can be very effective if well-designed and based on a sound policy rationale. Green tax reforms, for example, can encourage environmental innovation. Standards and smart regulation are a way to make markets more active in innovation. Better use of public procurement can also be effective, in particular when government is a large consumer.

**Towards coherent policies**

6. There is no silver bullet. Policy for innovation will be successful if it enhances the performance of the system as a whole, as weak links in the system will hinder its performance. In all countries, the priority

assigned to different elements depends on the nature and state of their system of innovation: one size does not fit all. Policy must also recognise that innovation in today's world relies on collaboration among a wide range of partners – producers but also users of innovation. Information and communication technologies, especially the Internet, facilitate that collaboration. These partners include new global players such as China, Brazil and India, which have shifted the topography of innovation and contributed to the global networks of innovation that have transformed how innovation is performed, where it occurs, who does it and why.

7. Work at the OECD has drawn attention to elements requiring greater emphasis in today's complex innovation landscape, as part of a wide-ranging approach to strengthening innovation (Box 1):

- Human ingenuity and the entrepreneurial spirit are the essence of innovation. Empowering people to innovate calls for broad and relevant education as well as the development of wide-ranging skills that complement formal education. Curricula and pedagogies need to be adapted to equip students with the capacity to learn and apply new skills throughout their lives.
- Firms are the essential means of translating knowledge and ideas into jobs and wealth. Small and medium-sized enterprises, especially new and young firms, are particularly important for innovation and job creation, as they exploit opportunities that have been neglected by more established companies. Governments must put in place policies to support new and innovative entrepreneurial efforts.
- Science is vital to innovation, especially to generate “step changes” such as the discovery of the transistor or vaccines. Fundamental R&D, mostly undertaken and funded by governments, provides the foundation for future innovation. The Internet is one outcome among many.
- Government support for platforms that enable more actors to engage in innovation networks is an essential underpinning. High-speed broadband connections, for example, allow actors to collaborate, make a wide range of data and information available and provide access to powerful analytical tools that facilitate the creation of new value.
- Improvements of markets and networks for exchanging and diffusing knowledge and intellectual property are needed, along with an effective system of intellectual property rights with new collaborative mechanisms, such as licensing markets, patent pools and clearing houses.

8. The broad concept of innovation embraced in this report emphasises the need to reach across the boundaries of ministries, institutions, sectors, fields of training, academic disciplines, regions and countries. Policies that are vertical in nature and target a particular field, sector, technology or location no longer suffice on their own. They need to be complemented by a horizontal – whole of government – policy approach to innovation. Achieving this is far from simple, but it holds the promise of greater coherence, better performance and a structure more appropriate to the central role of innovation in society today. It calls for coherence and complementarities between the local, regional and national levels. It requires stable platforms for co-ordinating actions, a focus on policies with a medium- and long-term perspective, and leadership by policy makers at the highest level. The budget process can help to develop a long-term vision for innovation by enhancing co-ordination and helping to secure funds on a multi-annual basis. Involving stakeholders in policy development can also help and can lead to policies that meet social goals more effectively.

9. Enhancing the effectiveness, coherence and efficiency of policies to foster innovation requires evaluation. It is a crucial means of establishing the legitimacy and credibility of government intervention. Better means of assessment are needed, as is better feedback of evaluation outcomes into policy making. This implies better measurement of innovation and its role in economic growth. Current innovation indicators focus too much on the inputs rather than the outcomes of the innovation process, and the aggregate numbers available do not adequately reflect the diversity of innovation actors and processes. The new set of indicators developed in the course of this OECD project clearly shows that innovation goes well beyond R&D. But it is only a start. What is needed now is a wide-ranging measurement agenda.

### **Box 1. Policy principles for innovation**

#### **1. Empowering people to innovate**

- Education and training systems should equip people with the foundations to learn and develop the broad range of skills needed for innovation in all of its forms, and with the flexibility to upgrade skills and adapt to changing market conditions. To foster an innovative workplace, ensure that employment policies facilitate efficient organisational change.
- Enable consumers to be active participants in the innovation process.
- Foster an entrepreneurial culture by instilling the skills and attitudes needed for creative enterprise.

#### **2. Unleashing innovations**

- Ensure that framework conditions are sound and supportive of competition, conducive to innovation and are mutually reinforcing.
- Mobilise private funding for innovation, by fostering well-functioning financial markets and easing access to finance for new firms, in particular for early stages of innovation. Encourage the diffusion of best practices in the reporting of intangible investments and develop market-friendly approaches to support innovation.
- Foster open markets, a competitive and dynamic business sector and a culture of healthy risk-taking and creative activity. Foster innovation in small and medium-sized firms, in particular new and young ones.

#### **3. Creating and applying knowledge**

- Provide sufficient investment in an effective public research system and improve the governance of research institutions. Ensure coherence between multi-level sources of funding for R&D.
- Ensure that a modern and reliable knowledge infrastructure that supports innovation is in place, accompanied by the regulatory frameworks which support open access to networks and competition in the market. Create a suitable policy and regulatory environment that allows for the responsible development of technologies and their convergence.
- Facilitate efficient knowledge flows and foster the development of networks and markets which enable the creation, circulation and diffusion of knowledge, along with an effective system of intellectual property rights.
- Foster innovation in the public sector at all levels of government to enhance the delivery of public services, improve efficiency, coverage and equity, and create positive externalities in the rest of the economy.

#### **4. Applying innovation to address global and social challenges**

- Improve international scientific and technological co-operation and technology transfer, including through the development of international mechanisms to finance innovation and share costs.
- Provide a predictable policy regime which provides flexibility and incentives to address global challenges through innovation in developed and developing countries, and encourages invention and the adoption of cost-effective technologies.
- To spur innovation as a tool for development, strengthen the foundations for innovation in low-income countries, including affordable access to modern technologies. Foster entrepreneurship throughout the economy, and enable entrepreneurs to experiment, invest and expand creative economic activities, particularly around agriculture.

#### **5. Improving the governance and measurement of policies for innovation**

- Ensure policy coherence by treating innovation as a central component of government policy, with strong leadership at the highest political levels. Enable regional and local actors to foster innovation, while ensuring co-ordination across regions and with national efforts. Foster evidence-based decision making and policy accountability by recognising measurement as central to the innovation agenda.

**MINISTERIAL REPORT ON THE OECD INNOVATION STRATEGY  
FOSTERING INNOVATION TO STRENGTHEN GROWTH AND ADDRESS GLOBAL AND  
SOCIAL CHALLENGES**

**KEY FINDINGS**

**Introduction**

*The current economic and social challenges are enormous ...*

*... and often global in nature.*

*Innovation can help accelerate the recovery and put countries back on a path to sustainable – and greener – growth.*

*Innovation policies are therefore of crucial importance for emerging from the crisis ...*

1. Today, the world's societies face severe economic and social challenges. The 2008-09 economic downturn has led to reduced potential output growth, rising unemployment and soaring public debt. To recover, countries need to find new and sustainable sources of growth.

2. The search for new sources of growth comes however at a time when many countries have stagnating or declining populations and face diminishing returns from labour inputs and investment in physical capital. Future growth must therefore increasingly come from innovation-induced productivity growth. Innovation – the introduction of a new or significantly improved product, process or method (Box 1) – holds the key to boosting productivity

3. Countries' economic difficulties come at a time of increasing political pressure to meet various social challenges, many of which are global in nature (such as climate change) or require global action (health, food security, the growing scarcity of clean water). Without a strong and co-ordinated policy response to such problems, the future looks bleak: global temperatures may increase by 4-6°C by the end of the century, the world will have to feed 3 billion more people by 2060, and 14-17 million people will continue to die every year from infectious diseases that could be cured or avoided. Such challenges cannot be dealt with single-handedly by any country and require a more co-ordinated effort by countries through supply- and demand-side interventions. Innovation, and coherence in policy interventions, is necessary to address these and other problems in an affordable and timely manner.

4. Innovation is thus essential if countries and firms are to recover from the economic downturn and thrive in today's highly competitive and connected global economy. It is a powerful engine for development and for addressing social and global challenges. And it holds the key, both in advanced and emerging economies, to employment generation and enhanced productivity growth through knowledge creation and its subsequent application and diffusion.

5. Yet the current economic environment raises a risk that governments will make policy and budgeting decisions that are not the best for the medium term and may harm innovation and longer-term prosperity. It is crucial to continue to invest in future long-term sources of growth, such as education, infrastructure and research. This must be a continuing priority as countries seek to move beyond the current crisis. While cutting back public investment in support of innovation may provide short-term fiscal relief, it will hurt long-term growth. The focus on these areas in recent stimulus packages was welcome, but a continuing strong baseline of investment is essential if productivity benefits are to

accrue and a return to growth is to be achieved. Moreover, innovation-driven growth makes it easier for governments to make the necessary investments and policy interventions to address the many global challenges facing society. At the same time, there is much scope to improve the efficiency of government spending and to innovate in the delivery of public services.

**Box 1. Defining and measuring innovation**

There is growing recognition that innovation encompasses a wide range of activities in addition to R&D, such as organisational changes, training, testing, marketing and design. The latest (third) edition of the *Oslo Manual* defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

By definition, all innovation must contain a degree of novelty. The *Oslo Manual* distinguishes three types of novelty: an innovation can be new to the firm, new to the market or new to the world. The first concept covers the diffusion of an existing innovation to a firm – the innovation may have already been implemented by other firms, but it is new to the firm. Innovations are new to the market when the firm is the first to introduce the innovation on its market. An innovation is new to the world when the firm is the first to introduce the innovation for all markets and industries.

Innovation, thus defined, is clearly a much broader notion than R&D and is therefore influenced by a wide range of factors, some of which can be influenced by policy. Innovation can occur in any sector of the economy, including government services such as health or education. However, the current measurement framework applies to business innovation, even though innovation is also important for the public sector. Consideration is being given to extending the methodology to public sector innovation and innovation for social goals.

Source: OECD and Eurostat (2005), *Oslo Manual – Guidelines for Collecting and Interpreting Innovation Data*, OECD, Paris.

*... even in countries with limited scope for public investment.*

6. Even countries with constrained public finances can do much to strengthen innovation. Governments establish the frameworks, regulations and markets that enable firms and other actors to engage in innovation. Structural reforms in education and training policies, in entrepreneurship policies, in product and labour markets, in public research institutions, and in policies to help develop networks and markets for knowledge can go a long way towards improving the environment for innovation. Pro-growth tax reforms can also help to strengthen growth and innovation.

*Demand-side policies can help stimulate innovation when matched with effective supply-side measures.*

7. Governments play a fundamental role in determining demand-side policies, such as smart regulations, standards, pricing, consumer education, taxation and public procurement that can affect innovation. Because demand is necessarily linked to supply, policies that affect both need to be better harnessed to drive long-term innovation and sustainable growth. Establishing a sound rationale for government intervention is important in this context. The idea that “market failures” lead to underinvestment in research has long been the principal rationale for government funding of research and development (R&D). However, the presence of bottlenecks or other failures that impede the operation of the innovation system can also constitute crucial obstacles to the effectiveness of the innovation effort.

*Policies for innovation should reflect innovation as it occurs today ...*

8. Policies to stimulate innovation need to take account of changes in the global economy and the transformation of innovation processes. To transform invention into innovation successfully requires a range of complementary activities, including organisational changes, firm-level training, testing, marketing and design. Innovation today encompasses

much more than research and development (R&D), although R&D remains vitally important. Innovation rarely occurs in isolation; it is a highly interactive process of collaboration across a growing and diverse network of stakeholders, institutions and users. Moreover, the emergence of new and important players has added to the complexity of the multifaceted international landscape of innovation.

*... and meet the needs of society.*

9. These factors require rethinking innovation policy in order to move beyond supply-side policies focused on R&D and specific technologies to a more systemic approach that takes account of the many factors and actors that influence innovation performance, including demand-side policies. The policy objective should not be innovation as such, but its application to make life better for individuals and society at large. This is no easy task, especially as the scope for policies for innovation broadens. Effective policies will require priority setting and strategic decisions, safeguards against favouring a particular firm or region for political as opposed to economic or social reasons, and recognition that striving for “whole of government” co-ordination involves transaction costs. The objective of the OECD’s work to develop a strategy for developing policies for innovation is to support this process, avoid these pitfalls and provide guidance to achieve these goals.

*The OECD Innovation Strategy offers a broad-based approach to promoting innovation.*

10. The OECD Innovation Strategy is built around five priorities for government action, which together can underpin a strategic and broad-based approach to promoting innovation for the 21<sup>st</sup> century:

- Empowering people to innovate.
- Unleashing innovation in firms.
- Creating and applying knowledge.
- Applying innovation to address global and social challenges; and
- Improving the governance and measurement of policies for innovation.

These priorities are backed by a set of policy principles for innovation (Box 2), which are discussed in more detail below. The priority assigned to each of these principles depends on the nature and state of the system of innovation in each country, as “one size does not fit all”. However, because of the interactions within the innovation system, attention must be given to all policy areas to improve its operation.

**Box 2. Policy principles for innovation**

**1. Empowering people to innovate**

- Education and training systems should equip people with the foundations to learn and develop the broad range of skills needed for innovation in all of its forms, and with the flexibility to upgrade skills and adapt to changing market conditions. To foster an innovative workplace, ensure that employment policies facilitate efficient organisational change.
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**4. Applying innovation to address global and social challenges**

- Improve international scientific and technological co-operation and technology transfer, including through the development of international mechanisms to finance innovation and share costs.
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- To spur innovation as a tool for development, strengthen the foundations for innovation in low-income countries, including affordable access to modern technologies. Foster entrepreneurship throughout the economy, and enable entrepreneurs to experiment, invest and expand creative economic activities, particularly around agriculture.

**5. Improving the governance and measurement of policies for innovation**

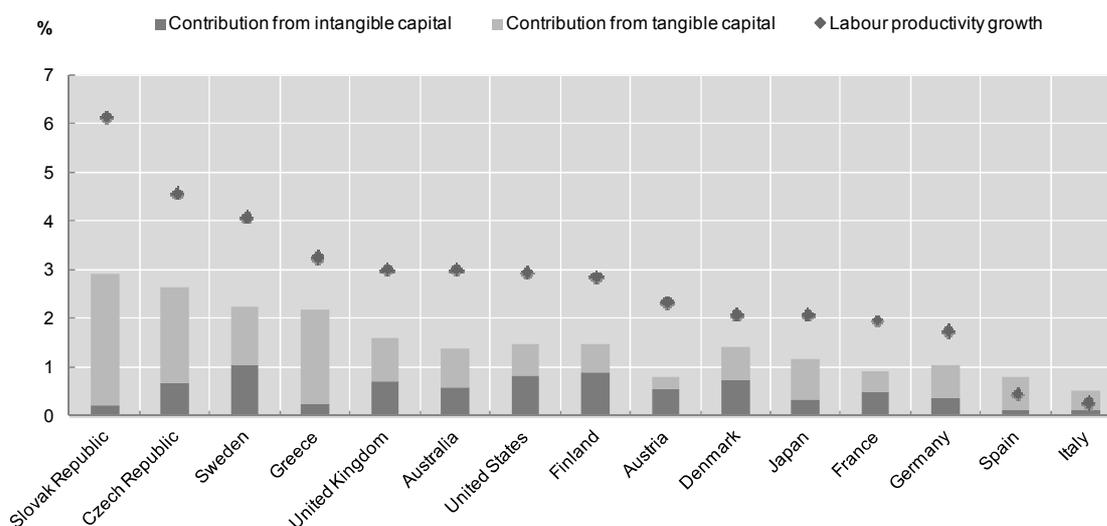
- Ensure policy coherence by treating innovation as a central component of government policy, with strong leadership at the highest political levels. Enable regional and local actors to foster innovation, while ensuring co-ordination across regions and with national efforts. Foster evidence-based decision making and policy accountability by recognising measurement as central to the innovation agenda.

## Innovation drives growth and is essential for addressing global and social challenges

*Innovation accounts for the bulk of labour productivity growth in OECD countries ...*

11. Innovation has been and must continue to be a major driver of rising living standards. Preliminary estimates for several OECD countries show that firms now invest as much in intangible assets related to innovation (R&D, software, skills, organisational know-how and branding) as they invest in traditional capital such as machinery, equipment and buildings. Such investment accounted for up to 1 percentage point – or around one-quarter – of labour productivity growth in Austria, Finland, Sweden, the United Kingdom and the United States between 1995 and 2006 (Figure 1). Moreover, much multifactor productivity (MFP) growth – that is, the joint productivity of capital and labour – is linked to innovation and improvements in efficiency. Collectively, estimates suggest that investment in intangible assets and MFP growth accounted for between two-thirds and three-quarters of labour productivity growth in OECD countries such as Austria, Finland, Sweden, the United Kingdom and the United States between 1995 and 2006. Innovation was the main driver of growth. Differences in MFP also account for much of the gap between advanced and emerging countries, an indication that innovation is also a key source of future growth for emerging economies.

**Figure 1. Intangible capital accounts for a large share of labour productivity growth**  
Percentage contributions, market sector, 1995-2006 (or nearest available year)



Note: The estimates are based on national studies. They do not yet reflect standardised methods and definitions. Figures for Japan refer to the whole economy. As shown in various OECD studies, labour productivity can be affected by demographic trends and employment dynamics, e.g. in Spain.

Source: OECD, based on COINVEST and national studies.

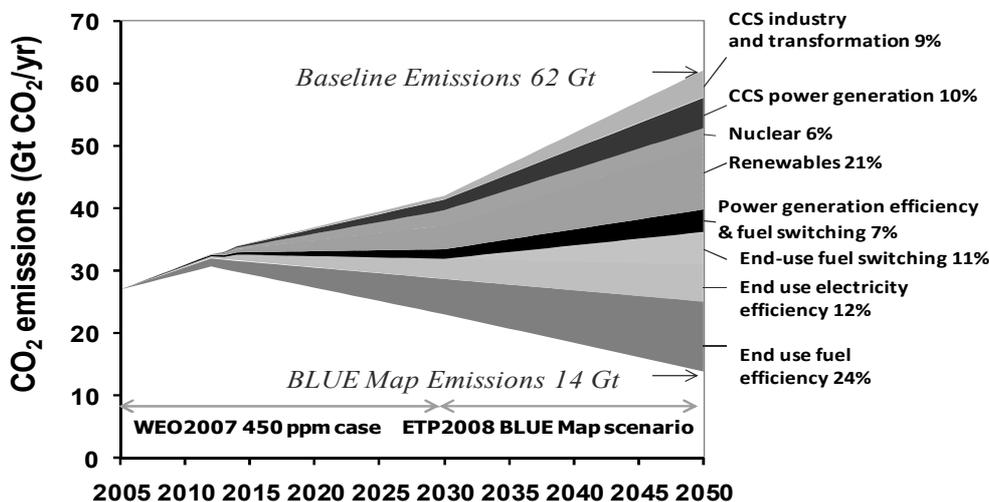
*... and helps drive the creation of new jobs.*

12. Innovation contributes to the creation of new jobs and industries. OECD cross-country analysis finds that employment in less productive firms tends to decline, while more productive firms create additional jobs. In the long run, innovation and employment creation go hand in hand, contributing to an inclusive and high-employment economy. However, innovation may lead to substantial job shifts across sectors and thus requires well-functioning labour markets, as well as labour, education and training policies that help displaced workers move into new jobs.

*It is crucial for meeting global and social challenges.*

13. Innovation is a critical part of the solution when tackling important societal challenges, whether at the global or the local level. The effects of greenhouse gas (GHG) emissions are global, irrespective of their place of origin, and any innovations that reduce GHG emissions will benefit all countries. Other problems require global action but may be more local in nature – for example, many of the most devastating infectious diseases are essentially local, but global action is needed to deal with them and the resulting benefits will be felt everywhere. Volatile food prices and food security have also become key issues for both developed and developing countries. Solutions will not come from the market alone; all these challenges require global action. Climate change mitigation, for example, will depend on the creation and application of a range of technologies and innovations across the globe (Figure 2).

**Figure 2. Contribution of key technologies to climate change mitigation**  
Gigatons of CO<sub>2</sub> per year, percentages



Note: WEO refers to the IEA's 2007 *World Energy Outlook*.

Source: International Energy Agency, *Energy Technology Perspectives 2008: Scenarios and Strategies to 2050*.

**Policies need to reflect innovation as it occurs today**

*Innovation requires a wide range of activities ...*

14. If policies to promote innovation are to be effective, they need to take account of the ways in which innovation takes place today. To transform ideas and inventions into innovation requires a range of activities, including organisational changes, firm-level training, testing, marketing and design.

*... of which science is not the least important.*

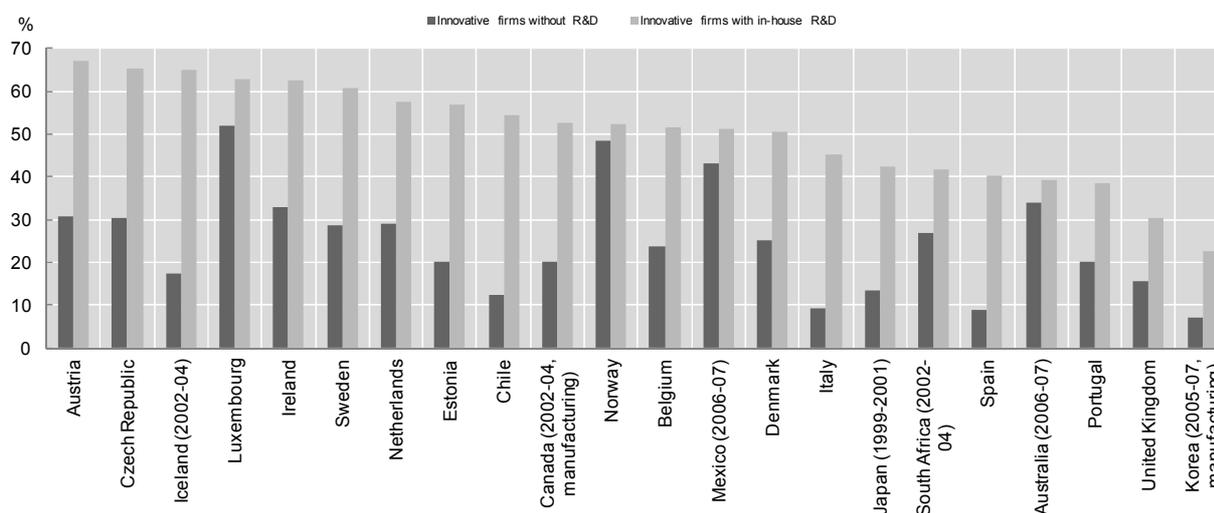
15. Science continues to be an essential ingredient of innovation. Modern innovations, from the transistor to the Internet search engine, have drawn on scientific knowledge. Most basic research is still done in the public sector, predominantly by higher education establishments or by public research institutions. Data on science-patent linkages show that the role of science in innovation continues to increase and that sectors such as pharmaceuticals and semiconductors rely heavily on scientific research, which is becoming increasingly multi-disciplinary in nature.

*It encompasses much more than R&D.*

16. While R&D remains vitally important, many highly innovative firms do not engage in R&D at all (Figure 3). Increasingly, firms in services and manufacturing create value through a wide range of complementary technological and non-technological changes and innovations.

**Figure 3. New-to-market product innovators, 2004-06**

As a percentage of innovative firms by R&D status



Note: In Luxembourg 52% of non-R&D performers introduced new-to-market innovations as compared to 63% of in-house R&D performers.

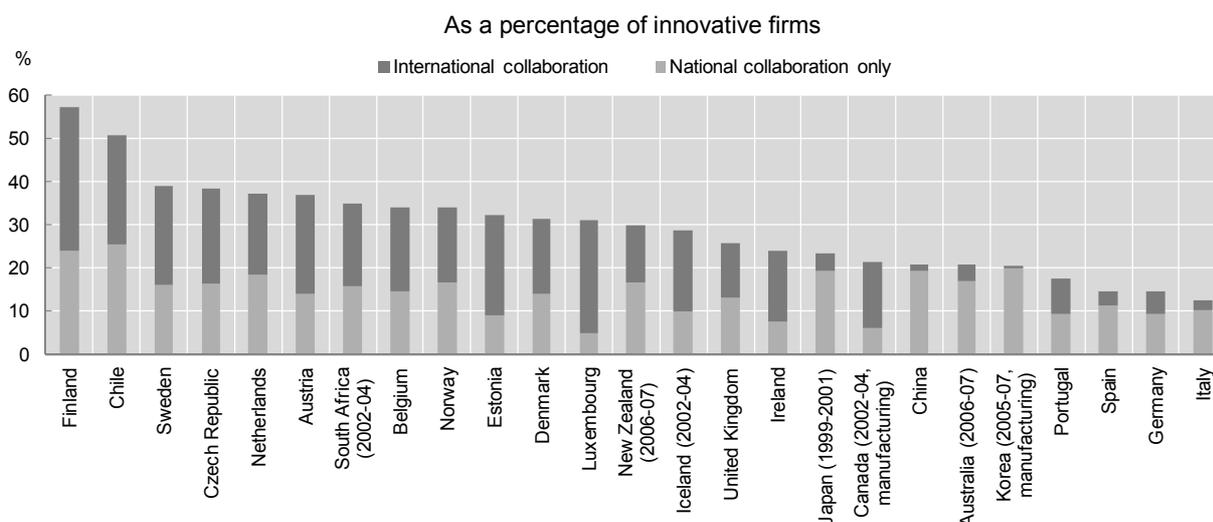
Source: OECD (2010), *Measuring Innovation: A New Perspective*, OECD, Paris, based on OECD, Innovation microdata project.

*... and is being opened up ...*

17. As the complexity and costs of engaging in innovation – in particular at the frontier – have increased, so has collaboration. Through partnerships, firms seek to stay abreast of developments, expand their market reach, gain access to a larger base of ideas and technology, and get new goods or services to market before their competitors. OECD analysis shows that firms that collaborate on innovation spend more on innovation than those that do not, an indication that collaboration is more a means to extend the scope of a project or complement firms' competencies than simply a means to save on costs. In most countries, collaboration with foreign partners is at least as important as domestic co-operation, a sign of the formation of global networks of innovation (Figure 4).

*... as firms source knowledge through many channels.*

18. Firms source external knowledge through partnerships, alliances and joint ventures with external parties or through the acquisition of knowledge, e.g. through contract R&D and licensing of patents. They also increasingly seek external partners, partly through emerging knowledge markets, to commercialise innovations that are not used internally. The effective management and enforcement of intellectual property (IP) is crucial to these arrangements, not only to identify useful external knowledge, but especially to leverage a firm's intellectual assets to create value.

**Figure 4. Firms with national/international collaboration on innovation, 2004-06**

Source: OECD (2010), *Measuring Innovation: A New Perspective*, OECD, Paris based on OECD, Innovation microdata project.

*Users and consumers are helping to propel a virtuous cycle of innovation.*

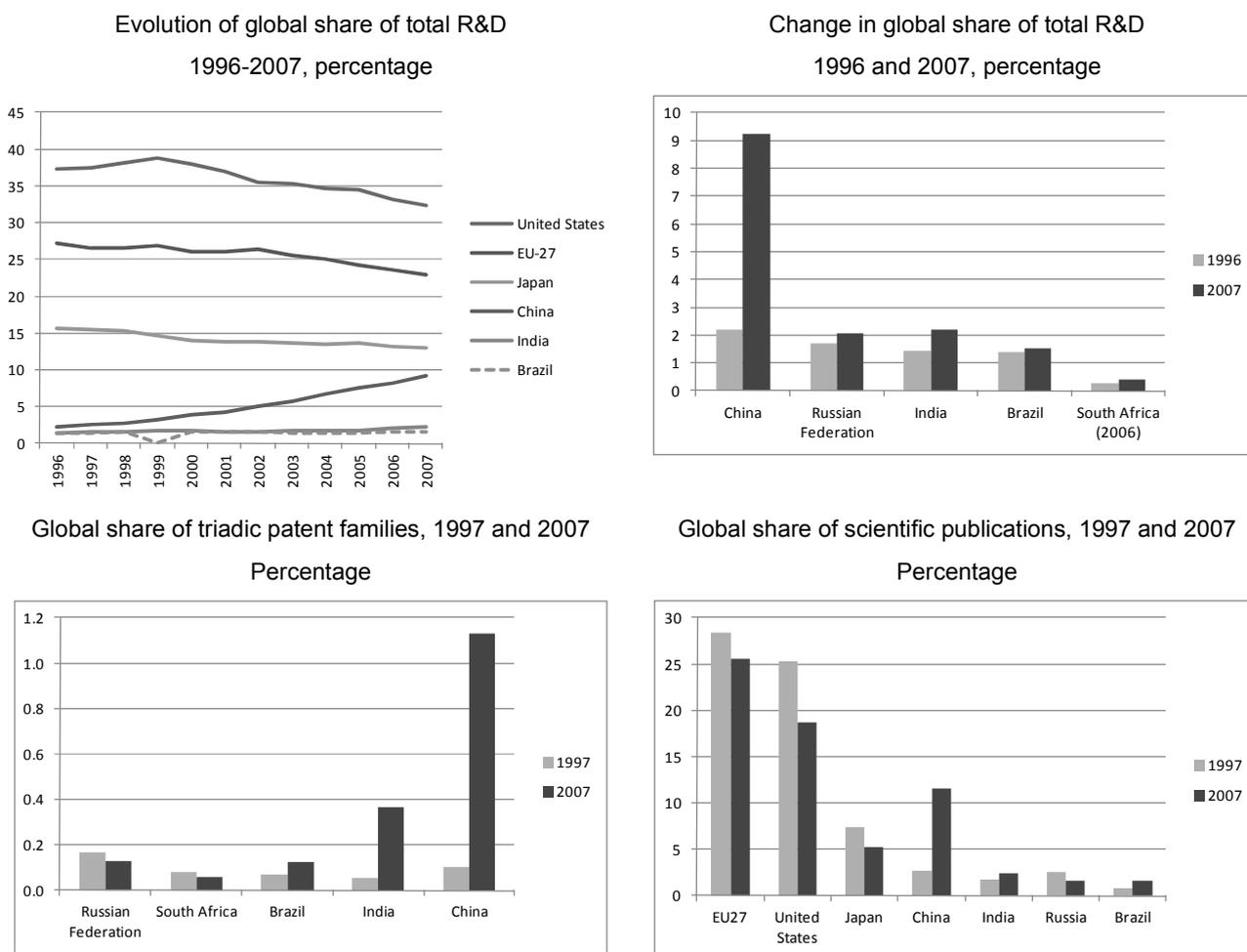
19. Users and consumers play a growing role with firms involving them in the innovation process in order to better satisfy their needs. Firms recognise this as a way to explore new growth opportunities at lower risk and to offer greater flexibility without necessarily incurring high costs. Users' experience with products can help focus future innovations. The virtuous cycle of innovation can be better facilitated through increasing interaction between demand and supply.

*New players have emerged ...*

20. The international landscape for innovation has seen the emergence of new and important players. Rapid growth in the People's Republic of China (China) has been accompanied by a dramatic increase in R&D expenditure. China accounted for almost a third of the global increase in R&D between 2001 and 2006, as much as Japan and the EU combined. Brazil and India are also taking their place on the global innovation landscape (Figure 5).

*... and innovation activities increasingly reach across the globe ...*

21. Multinational firms play a leading role in the globalisation of innovation. Close to half of the world's R&D expenditure is accounted for by only 700 firms, and these have been a key factor in the emergence of global innovation networks. They are increasingly expanding their innovation activities worldwide as a way to enter markets and lower costs, but also to source technological capabilities, tap into local centres and clusters of knowledge, and gain access to highly skilled workers.

**Figure 5. Global trends in major OECD regions and selected non-member economies**

*Note:* Patent counts are based on the earliest priority date, the inventor's country of residence and fractional counts. The data mainly derive from the EPO Worldwide Statistical Patent Database (September 2009). Patent counts are based on the earliest priority date, the inventor's country of residence and fractional counts. The data mainly derive from the EPO Worldwide Statistical Patent Database (September 2009).

*Source:* R&D figures based on data for 79 non-OECD countries (UNESCO Institute for Statistics) and 30 OECD countries (OECD Main Science and Technology Indicators Database 2009/2). OECD, Patent Database, 2010, and Scopus Database 2009.

... supported by international migration.

22. The emergence of global networks of innovation coincides with an increasingly global market for the highly skilled. Students travelling abroad are an important part of this phenomenon. The number of foreign students more than doubled between 1995 and 2006, and many stay on in their host country. Foreign staff and return immigrants are sought for their expertise, their language skills and their knowledge of foreign markets both in private industry and academia. China and India have benefited from a large and well-educated diaspora which has helped improve their innovation performance and growth through return migration, links to venture capitalists and access to networks of expertise.

*Yet local knowledge remains important in global networks.*

23. While firms can access factors of production across the globe, local knowledge and capabilities, including proximity to research and education institutions, continue to matter for innovation. Co-patenting is more frequent with inventors in the same region than in other domestic or foreign regions. Some regions have become global leaders in knowledge-intensive industries, while others have built on traditional industries to develop new and innovative activities. Nevertheless, half of the R&D in the OECD area is performed by 10% of its regions, an indication that the world of innovation is not flat.

*These trends call for rethinking policies to foster innovation.*

24. Such changes in the innovation process present a challenge to existing national policy frameworks. The focus on strengthening public research and on providing incentives for firms to invest in research and development is important, but it is not enough. A more strategic approach to fostering innovation is needed, one which considers the full spectrum of policies to create, diffuse and apply knowledge. These policies are considered in the sections that follow.

### **People should be empowered to innovate**

*People are the basis of innovation.*

25. Human capital is the essence of innovation. People generate the ideas and knowledge that power innovation, and they apply this knowledge and the resulting technologies, products and services in the workplace and as consumers. Innovation requires a wide variety of skills, as well as the capacity to learn, adapt or retrain, particularly following the introduction of radically new products and processes. Empowering people to innovate relies not only on broad and relevant education, but also on the development of wide-ranging skills that complement formal education. Opportunities to use and leverage these skills throughout the economy and society are vital.

*Education systems and curricula need to adapt to changing needs ...*

26. Formal education is the basis for forming human capital, and policy makers should ensure that education systems help learners to adapt to the changing nature of innovation from the start. This requires curricula and pedagogies that equip students with the capacity to learn and apply new skills throughout their lives. Emphasis needs to be placed on skills such as critical thinking, creativity, communication, user orientation and teamwork, in addition to domain-specific and linguistic skills.

*... and to provide a solid foundation for all.*

27. Despite the unprecedented rise in educational attainment in OECD countries, 7.3% of 15-19 year-olds are not in education or employment, and a considerable share of children do not complete upper secondary education. Yet this phase of education lays the foundation for other social, economic and educational outcomes, including the ability to work and contribute as an adult and should be universal. Improving teacher quality is important for enhancing outcomes; this might include better initial selection of teachers, ongoing evaluation to identify areas for improvement, and recognising and rewarding effective teaching. Reducing the variation in performance across schools is also important.

*High quality tertiary education systems play an essential role, ...*

28. Universities, colleges and vocational training centres are essential nodes in the innovation system, both producing and attracting the human capital needed for innovation. These institutions act as essential bridges between players – businesses, governments and countries – in broader and more open systems of innovation. They also contribute to the local quality of life and thus can help to attract the highly skilled from around the globe. World-class institutions can be the anchor for clusters of innovative activity. The major policy challenge is to recognise the essential role of universities in the innovation enterprise rather view them, as is all too commonly the case, simply as providers of essential public goods. This requires a greater focus of policy makers on ensuring independence, competition, excellence, entrepreneurial spirit and flexibility in universities.

*... vocational education and training must be connected to the world of work...*

29. Vocational education and training also play an important role in innovation, by helping firms make incremental changes to production processes and adopt technologies, and by lifting the overall capacity to innovate. Policies need to connect this training to the world of work, including by engaging employers and workers in curriculum development. Costs beyond the secondary level should be shared among government, employers and students. Vocational teaching and training should be improved and national assessments should be adopted to ensure quality and consistency.

*... and lifelong learning needs to be encouraged.*

30. The acquisition of skills is a lifelong process; it does not end with formal education. Schools lay a base for lifelong learning, but ongoing skills acquisition needs to be encouraged. This involves recognising all forms of learning and making them visible, including through qualification systems. Rewarding lifelong learning and making it attractive may help enhance participation.

*Education and training policies can help foster an entrepreneurial culture ...*

31. Entrepreneurs play a particularly important role in innovation by helping to turn ideas into commercial applications. Firms less than five years old accounted for nearly all of the increase in employment in the US private business sector from 1980 to 2005. Success in entrepreneurship often comes with practice, hence the importance of experimentation, entry and exits. Yet, only a small part of the population receives entrepreneurial education. Education and training policies should foster an entrepreneurial culture by instilling the skills and attitudes needed for creative enterprise.

*... but women often face specific barriers to participation in the innovation process.*

32. Women can also play a larger role in the innovation process. Although more women than men now obtain tertiary degrees, their participation in science and engineering, as well as in entrepreneurship, lags behind. Social and labour market policies, such as tax and benefit systems, workplace practices and policies relating to childcare, can give women an incentive to enter the labour force. Specific barriers to women's involvement in science and innovation include workplace practices (e.g. non-transparent hiring and promotion) in scientific institutions. The low participation of women – and other underrepresented groups – in certain parts of the innovation process limits diversity, which is essential for innovation to flourish.

*Governments should facilitate international mobility.*

33. Internationally mobile talent contributes to the creation and diffusion of knowledge, particularly tacit knowledge. To encourage this circulation of knowledge, governments can invest in public research to build absorptive capacity, open labour markets to foreign students for further training, and ensure that the tax regime does not penalise mobile skilled workers. For their part, sending countries can put in place policies and support measures (e.g. fellowships) that give expatriate researchers opportunities to re-enter the domestic labour market. Cross-border higher education should continue to be promoted as a means to build international networks of knowledge. Migration regimes for the highly skilled should be efficient, transparent and simple; they should enable movement on a short-term or circular basis. Policy should also support ongoing connections to nationals abroad. These policies need to be coherent with the wider migration agenda, and with development and aid policies, so as to contribute to the effective management of migration.

*Innovative workplaces can contribute to learning and to innovation.*

34. The organisational structures and employment policies that shape the workplace are essential for determining how human capital translates into innovation and productivity. Employee involvement and effective labour-management relations and practices help foster creativity and innovation and raise productivity. In particular, interaction and learning within firms enables employees to share information, challenge existing practices, and experiment and collaborate to improve products and processes. While governments do not play a direct role in the workplace, it is important to foster the conditions for learning in organisations and the workplace and to ensure that labour market policies are conducive to innovation and to mobility.

*Consumer policy and consumer education enable consumers to participate in and benefit from innovation.*

35. People participate in innovation not only by creating, diffusing or adapting technologies in the workplace, but also as consumers. A critical mass of users and consumers can support and encourage innovation and the competitive process. They have opportunities to influence the design, methods of supply, introduction and uptake of new products and services directly and they need to have the skills to make decisions on innovative products. Consumer policy regimes and consumer education should improve the functioning of markets by helping consumers to be active participants in the innovation process and enabling them to make informed choices. This has the added benefit of strengthening competition between businesses. An essential element of this process is ensuring that the information provided to consumers is easily understandable and takes account of how people process information. The OECD's Toolkit for Consumer Economics provides guidance to governments on how to make consumer policies effective in today's changing economic environment.

## Action should be taken to unleash innovations

### Foster entrepreneurship

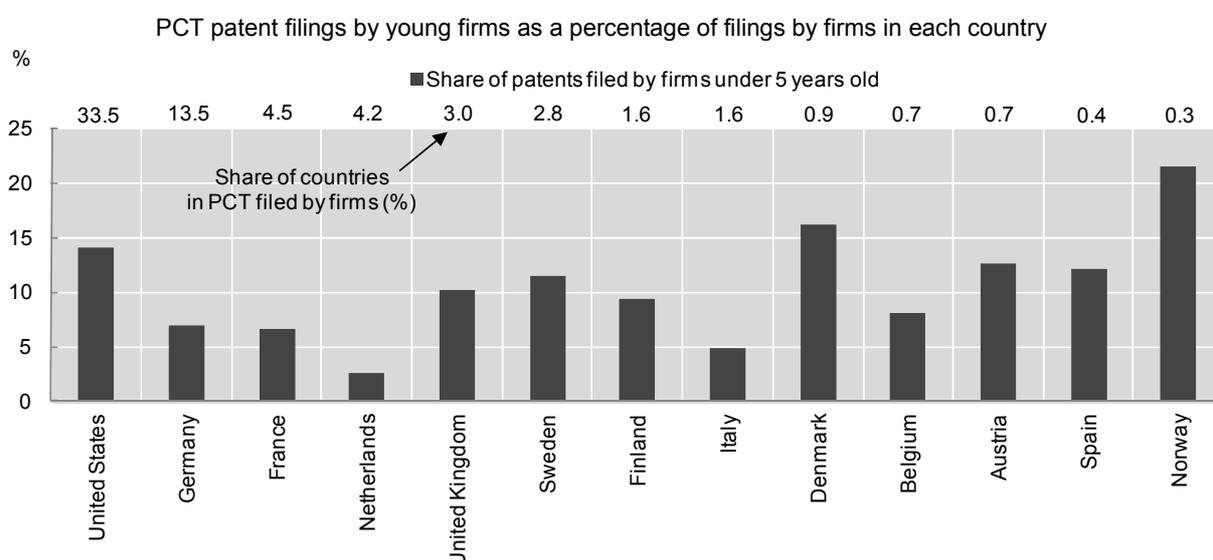
*Businesses, especially new and young firms, are the main source of job growth from innovation.*

*Barriers to firm entry and exit need to be reduced.*

36. Despite the increasing variety of actors in the innovation process, firms remain the pre-eminent means of translating good ideas into jobs and wealth. New and young firms are particularly important, as they often exploit technological or commercial opportunities that have been neglected by more established companies. A policy environment that fosters the start-up and expansion of new firms is therefore critical for innovation to flourish.

37. Entrepreneurs who develop new products, services and processes or improve existing ones fuel innovation. Newly created firms can be very inventive, and they account for a large share of patenting in OECD countries (Figure 6). Both market entry and exit are indispensable for the experimentation that leads to the development of new technologies, processes, business methods and markets. Analysis of Europe's fastest-growing companies shows that companies founded by repeat entrepreneurs have higher turnover and employment growth than companies run by entrepreneurs who have never failed. Simplifying and reducing start-up regulations and administrative burdens can reduce barriers to entry. Since firms planning to enter the market may have little idea of their chances of survival, costly exit can discourage them from entering. In many countries, including at EU level, bankruptcy laws are needed to facilitate the restructuring of ailing businesses, with due regard to risk management and the need to avoid moral hazard.

**Figure 6. Patenting activity of young firms, 2005-07**



Note: Data refer to patent applications filed under the Patent Co-operation Treaty (PCT) by firms with a priority in 2005-07. Counts are based on a set of patent applicants successfully matched with business data. US firms account for 33.5% of overall PCT filings by firms, and 14% of these are applied for by firms under five years old.

Source: OECD (2010), *Measuring Innovation: A New Perspective*, based on HAN database, October 2009 and Bureau Van Dijk Electronic Publishing, August 2008.

*The tax climate for entrepreneurs should be more neutral.*

38. Personal income tax, corporate income tax and social security contributions have their part in decisions to move from dependent employment to establishing a business, and in the structure of such businesses (incorporated or unincorporated). Changes that provide more neutral tax treatment should be considered. The financial and health costs associated with losing employer-based health insurance and social security contributions can make people reluctant to leave salaried employment and discourages entrepreneurship. Where possible, barriers to the transferability of such benefits should be lowered.

*Policies that facilitate structural change are crucial for reallocating resources.*

39. New enterprises drive many obsolete firms out of the market and often do not survive very long themselves. Evidence from OECD countries suggests that between 20% and 40% of entering firms fail within the first two years. This reallocation of resources to more efficient and innovative firms is central to innovation and economic growth and should be based on open and competitive markets. Labour market policies should provide the flexibility and mobility necessary to enable reallocation of resources from declining to innovative firms, along with support for lifelong learning and re-skilling of workers.

*Regulatory barriers that increase with firm size limit growth and need to be reviewed.*

40. The expansion of existing firms is a particular challenge in many countries. Low regulatory barriers can help ensure that gazelles and other high-growth firms do not spend the capital needed to support their growth on overcoming bureaucratic obstacles. Administrative, social and tax requirements that tend to rise with company size require attention, as they increase the cost of expansion. This effect is further amplified when public support depends on firm size. Support that is strongly focused on innovation and allocated on the basis of the firm's age has been effectively deployed in some countries.

*Policies that can help lift the performance of existing SMEs are also important.*

41. Improving the innovative capabilities of existing small and medium-sized firms is also an important policy challenge in many OECD countries. Policy can help to improve access to finance, to enable small and medium-sized enterprises (SMEs) to participate in knowledge networks, and to strengthen the skills that can lead to innovation.

### ***Enhance access to finance***

*Access to finance is crucial if innovation is to flourish.*

42. In addition to the regulatory framework, access to finance is a key constraint for business-led innovation which is inherently risky and may require a long-term horizon. Restoring the health of the financial sector should therefore be a priority. Financial constraints are especially high for new entrants, since they have no history of success and their assets may be difficult to value.

*Financing innovation requires well-developed financial markets ...*

43. Well-functioning venture capital markets and the securitisation of innovation-related assets (e.g. intellectual property) are key sources of finance for many innovative start-ups and need to be developed further. Financial market reforms in the aftermath of the crisis need to encourage a better balance between the search for return and prudence with regard to risk. Financial markets should continue to provide sufficient room for healthy risk taking, long-term investment and entrepreneurship, all key drivers of innovation, while ensuring safeguards in case of failure.

*... and policies to ease access to finance for new and small innovative firms.*

44. Policy makers can also take steps to ease new and small innovative firms' access both to debt finance (the prevalent source of external funding for all enterprises, including innovative firms) and to equity finance. This can involve risk-sharing schemes with the private sector.

*Policy should support early-stage financing and networks for venture capital and business angels.*

45. Seed capital and start-up financing, by business angel funds and networks, play a key role in enabling entrepreneurial individuals to turn new ideas into new products. Access to these sources can provide more than just funding by helping start-ups to develop and giving advice and on-the-ground management expertise. Government can encourage such networks and associated markets. When public funds are deployed, they should be channelled through existing market-based systems and private funds and take a clear market approach. Policy should focus on developing the market, rather than simply on providing finance. This requires incentives to develop the necessary quality, skills and experience in financial firms.

*It should also encourage the diffusion of best practices in financial reporting.*

46. Ensuring that information on intellectual assets (e.g. R&D, patents, software, databases, organisational capital) is consistent and comparable over time and across companies would help investors to better assess future earnings and the risks associated with different investment opportunities. This can help make financial markets more efficient and improve firms' ability to secure funding at lower cost. Governments can assist in efforts to promote identification and dissemination of best practices in reporting. Given the wide range of intellectual assets held by firms in different industries, and the comparatively early stage of development of reporting frameworks, the approach to improved disclosure should remain principles-based.

### ***Build the foundations for innovation in business with sound framework conditions***

*Sound framework conditions are an essential basis for policies to strengthen innovation.*

47. The foundations for innovative activity must be sound for firms to participate in innovation and for its benefits to spread throughout the economy and society. A policy environment based on core "framework conditions" – sound macroeconomic policy, competition, openness to international trade and investment, tax and financial systems – is a fundamental building block of an effective innovation strategy and allows innovation to thrive.

*Stable macroeconomic policies help reduce uncertainty ...*

48. Fiscal discipline and low and relatively stable inflation rates help reduce uncertainty and enhance the efficiency of the price mechanism in allocating resources. Strong and stable rates of output growth also support firms seeking to introduce new products or undertake significant organisational changes.

*... and open and competitive markets are essential drivers of innovation.*

49. There is considerable scope for further opening markets to competition. Strong competition encourages companies to innovate, develop new markets and to stay ahead of competitors. At the same time, a degree of market power may encourage innovation activity by facilitating the recovery of related expenses. Elimination of anticompetitive product market regulations is a powerful way to stimulate investment in innovation;

the OECD has developed a Competition Policy Toolkit to help governments in this area. In addition, sound, proactive competition policies in line with international best practice can encourage innovation in markets that might otherwise stagnate.

*More open international markets would facilitate the spread of knowledge.*

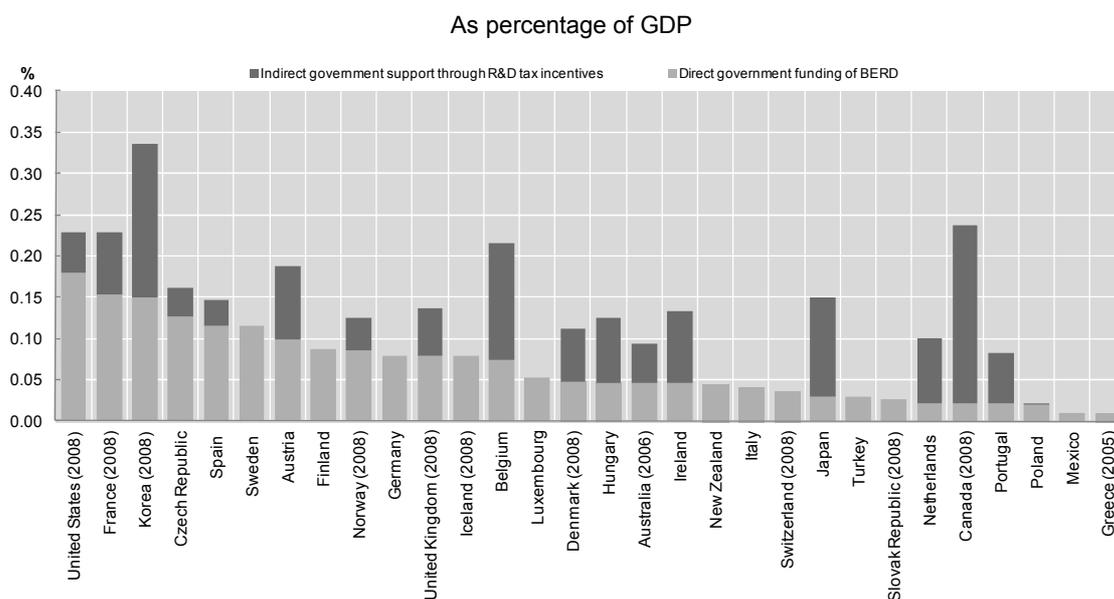
50. Progress in reducing tariff barriers, dismantling non-tariff barriers and liberalising capital markets, combined with a rules-based international framework, has opened up opportunities for trade and international investment. It increases the size of markets available to innovators and consumers and facilitates the spread of knowledge, technologies and new business practices. More open trade in services, reduced border protection for merchandise trade, modernised public procurement, and a sound international framework for intellectual property rights (IPR), including the conditions for enforcing these rights should foster innovation. The conclusion of the WTO's Doha Development Agenda, and improved market access for goods and services, would be a significant step towards further market opening. Governments should also consider the quality of their policy frameworks for investment, which are important not only in determining how much investment an economy receives, but also the extent to which this investment contributes to economic development and acts as a driver of innovation.

*Tax policy affects investment in innovation.*

51. Tax policies affect the decisions of firms and households to save or invest and can have a bearing on innovative activity. To encourage innovation, the tax system should not hinder investment in innovation through the purchase or licensing of tangible and intangible capital, the employment of skilled workers or access to finance. Likewise, asymmetric taxing of gains and losses may discourage healthy risk taking and stifle innovative activity. Treatment of capital gains and losses realised on shares issued by innovative companies should be balanced, so as to encourage equity investment in these firms. R&D tax credits can be a relatively attractive incentive mechanism for innovation and are used extensively in a number of OECD countries (Figure 7). However, in assessing the overall amount of tax relief in support of R&D, it is important for policy makers to examine not only R&D expenditures, but also the tax treatment of returns on that investment, including the jurisdiction in which those returns are taxed. Moreover, governments should ensure that their support for private R&D does not unduly distort competition and international trade.

*The quality of framework conditions counts when deciding on the location of investment.*

52. The importance of framework conditions, including the need for a level playing field, has increased in recent years as businesses and capital seek the most favourable environments and become more mobile. Reaping the benefits of innovation at the national, regional and local level increasingly requires governments and other stakeholders to undertake the investments and policy reforms that provide a good environment for engaging in innovation. In addition to the quality of framework conditions, human capital, research and communications infrastructure, as well as the size and quality of local markets are factors that help economies attract investment in innovation.

**Figure 7. Direct and indirect government funding of business R&D and tax incentives for R&D, 2007**

*Note:* For Turkey, calculations by The Scientific and Technological Research Council of Turkey point to a figure of 593 million of Turkish liras (or 0.06% of GDP) as forgone tax revenue in 2008. Italy and Greece provided R&D tax incentives in 2007, however estimates of foregone tax revenues from those incentives are not yet available.

*Source:* OECD (2010), *Measuring Innovation: A New Perspective*, based on OECD, R&D tax incentives questionnaire, January 2010; and OECD, Main Science and Technology Indicators Database, March 2010.

### ***Foster markets for innovative goods, services and processes***

*Governments can foster markets for innovation.*

53. In most countries, demand for innovative products and services that meet social and global needs can be further encouraged. Getting prices right, opening markets for competition and devising innovation-inducing standards and regulations are approaches that governments can use to strengthen the role of markets and business in innovation. Well-designed demand-side policies are less expensive than direct support measures and are not directed at specific firms, but reward innovation and efficiency.

*Efficient regulations can facilitate innovation ...*

54. At the same time, government itself plays an important role through efficient public investment in the long-term drivers of change, well-designed standards and regulations, and innovative ways of leveraging public procurement. Good regulation can ensure that potential innovators have the incentives to develop and diffuse innovations that meet social objectives at least cost. Along with market-based policy measures, the OECD's Guiding Principles of Regulatory Quality and Performance can help in developing good regulations. Existing regulations should be reviewed regularly and the impact of new regulations assessed to ensure that they meet these standards.

*... and public procurement can be mobilised in markets where governments are large consumers.*

55. Public procurement provides important signals on future demand to the private sector. It can be effective in certain markets, in particular those in which the government is a large consumer. Yet, it is not without risks and should be designed to be efficient and not distort competition. The OECD Principles for Integrity in Public Procurement recognise the

considerable merit of transparent and competitive public procurement processes which help ensure good governance. Sub-national governments are important here, as they account, on average, for 64% of public investment in OECD countries.

### **Government action is needed to create and diffuse knowledge and reap its returns**

*Government plays a vital role in fostering public and private investment in innovation.*

56. While effective framework conditions are necessary to stimulate innovation, they are insufficient on their own. People and firms seeking to innovate depend on a wide array of public and private investments: infrastructure and networks that support innovation, human capital and R&D, as well as other “intangibles” such as access to data. However, private investment in innovation is often insufficient because returns are uncertain or firms cannot appropriate all the benefits of their investments. Private investment may not take place at all in areas such as basic science, where the time horizon is long and outputs are often not immediately marketable. Public investment provides the impetus to innovation, as in the case of the Internet, the browser or the Human Genome Project.

### **Foster strong and effective public research**

*Science remains a key driver of innovation.*

57. Science has always been at the heart of innovation and continues to be an essential ingredient. Science also makes important indirect contributions to innovation, e.g. by providing impartial scientific advice for policy making. As most scientific research is carried out by the public sector, a strong and effective public research system is crucial for innovation.

*Public research institutions should enhance excellence, ...*

58. The governance of research institutions and higher education institutions should seek to enhance excellence and to create better links to other innovation actors and stakeholders. This includes institutional mechanisms for financing public research to better facilitate funding of multidisciplinary research and increasing the ability of institutions to work more closely with industry to bring ideas to market. It could also involve tying a well defined part of funding more closely to societal objectives and missions such as sustainability and global challenges.

*... which will benefit from new mechanisms to finance research.*

59. Governments should adapt their mechanisms for financing research, for example by balancing competitively awarded project funding with other forms of funding and by giving universities and public research organisations greater autonomy for raising quality.

*Technology transfer from research institutions can be improved.*

60. Barriers and regulations that limit effective interaction among universities, firms and public laboratories should be removed and collaborative arrangements that facilitate the formation of networks should be improved. Ensuring that researchers, public research institutes and higher education institutions have incentives and opportunities to collaborate among themselves and with industry is essential. Criteria for evaluating research performance should be adjusted to reflect the multiple

missions of research institutions, including knowledge transfer. Clearly defined expectations and boundaries for collaboration and well-trained technology transfer personnel are essential to achieve this goal.

### ***Invest in a knowledge-supporting infrastructure***

*General-purpose technologies, notably ICTs, play a key role in fostering innovation.*

61. Today, high-speed communication networks support innovation throughout the economy much as electricity and transport networks spurred innovation in the past. Governments should promote information and communication technologies (ICTs) as general-purpose platforms for innovation and knowledge sharing by upholding the open, free, decentralised and dynamic nature of the Internet. This also means encouraging the adoption of the new standard for Internet Protocol (IPv6), since the lack of Internet addresses is increasingly a constraint for this key platform, in particular in developing countries.

*The development of next-generation, high-capacity broadband networks is essential ...*

62. Broadband networks provide a platform for the development and diffusion of smart infrastructures (energy, health, transport, education). Governments should promote this symbiotic relationship and ensure that broadband is available throughout their territory. This will allow other sectors to leverage the infrastructure to develop other platforms, such as distance education and telemedicine, and enable the development of digital content, including local content. Such investments must be accompanied by regulatory frameworks that support open access to networks and competition in the market.

*... and the physical infrastructure should include smart ICT solutions.*

63. Governments should foster the integration of ICT investments in physical infrastructure, such as buildings, roads, transport systems, health facilities and electricity grids, allowing them to be “smart” and thus save energy and improve safety and adaptability. These infrastructures can both lower barriers to entrepreneurial activities and support the efficient and “green” delivery of energy, mobility and important social services.

*Access to public-sector information should be facilitated.*

64. In addition to their hardware and software, ICT infrastructure carries publicly generated or funded information. Provision of this information at no or low cost can stimulate innovation and improve the transparency and efficiency of government. Obstacles that impede the commercial and non-commercial re-use of public-sector information include: restrictive or unclear rules governing access and conditions of re-use; unclear and inconsistent pricing of information when re-use is chargeable; complex and lengthy licensing procedures; inefficient distribution to final users; and barriers to development of international markets. Public information should remain open so as to eliminate exclusive arrangements and allow innovative commercial and non-commercial re-use, as noted in the 2008 OECD Council Recommendation on Public Sector Information.

*Infrastructure policy needs to be co-ordinated across technologies as they converge.*

65. ICTs also help connect elements of the global knowledge infrastructure (such as scientific databanks and large-scale science projects) in ways that amplify their utility and impact. And *in silico* modelling of complex scientific interactions increasingly reduces risk and

time lags associated with experimentation. The potential to drive safe and successful innovation based on a broad range of technologies, including through their convergence, is evident. Governments need to ensure that their infrastructure policies capture the benefits of such interactions and effectively co-ordinate ICT policies with innovation policies more generally. Examples include providing on-line access to science instruments (e.g. telescopes) or databases.

***Foster efficient knowledge flows, networks and markets***

*Knowledge drives economies, but mechanisms for its diffusion are not well developed.*

66. The creation, diffusion and application of knowledge are critical to the ability of firms and countries to innovate and thrive in an increasingly competitive global economy. But knowledge networks and markets are so far much less developed than product, labour and financial markets, though they are increasingly common in certain settings and sectors. Their development is important for stimulating innovation and improving its efficiency by reducing transaction costs. Public policy should therefore support the formation of knowledge networks and markets. This can be done through policies that encourage the development of knowledge brokerages. In appropriate cases these could facilitate the securitisation of intellectual assets, thereby enabling the capture of value on a much broader range of knowledge assets.

*Effective protection of IPRs is necessary to encourage innovation, investment and trade ...*

67. An important contributor to building such networks and markets is the ability to own certain kinds of knowledge, as recognised by intellectual property rights. IPRs provide an important incentive to invest in innovation by allowing firms to recover their investment costs. Patents are particularly important for small firms, as they can facilitate entry into new markets and enable competition and collaboration with other firms. IPRs should be well protected and appropriately enforced. Weak protection of IPRs undermines incentives to invest in innovation, facilitates counterfeiting and piracy, reduces the potential for technology transfer and limits the formation of markets for knowledge.

*... and must be combined with policies and mechanisms to facilitate access and transfer.*

68. However, the protection of knowledge needs to be combined with policies and mechanisms that facilitate access and transfer. Excessively strong IPR may hamper the appropriate use of protected knowledge and discourage follow-on research and research in adjacent areas to the detriment of both competition and innovation.

*The quality of patents is important to ensure competition.*

69. To encourage innovation and the diffusion of knowledge, IPR regimes should be of high quality and balanced. Patent systems need to be properly tailored to ensure the proper balance between incentives for innovation and the public benefit that flows from dissemination of the knowledge into the marketplace. Competition authorities play an important role in ensuring that patenting procedures are not abused and that patents are not used anti-competitively.

*Greater use can be made of IPRs and non-proprietary knowledge ...*

70. IPRs not only contribute to innovation, they are also a means of diffusing knowledge and creating value. A variety of collaborative mechanisms, such as licensing markets or pools and clearing houses, can facilitate access to and use of knowledge. Such arrangements are being promoted as part of emerging business models, along with mechanisms to facilitate the valuation and circulation of knowledge, such as brokerages and exchanges. To encourage the circulation of knowledge, a differentiated regime which takes into account the specificities of particular sectors may be needed.

*... including through cross-border flows of knowledge.*

71. Cross-border flows are a crucial source of knowledge, and many countries rely more on imported knowledge than on domestic R&D. To facilitate such flows and the market for knowledge, governments should consider opening national programmes to foreign-owned firms. Such arrangements should not be discriminatory and should be supported by open markets. Likewise, tax structures should facilitate cross-border transfers of intellectual property, both outbound and inbound, for example through a network of tax treaties or “foreign tax credit” rules designed to avoid double taxation of foreign income. Cross-country differences in regulations and commercial law (particularly as regards licensing contracts) should also be reviewed to facilitate cross-boundary knowledge flows.

*In a knowledge-based economy, governments need to take concrete steps to foster the development of knowledge networks and markets.*

72. In an economy increasingly based on knowledge and innovation, the development of fully functioning knowledge networks and markets can have a significant impact on the efficiency and effectiveness of innovation. Some good practice exists (for example, in networking R&D for emerging infectious diseases) but significant scale-up is required. Governments can: first, underpin the development of a knowledge networking infrastructure; second, implement measures, such as the OECD Guidelines on Access to Research Data from Public Funding, to share public-sector knowledge; and third, foster the development of collaborative mechanisms and knowledge brokerages to encourage the exchange of proprietary knowledge and a fair return on investments made.

### ***Unleash innovation in the public sector***

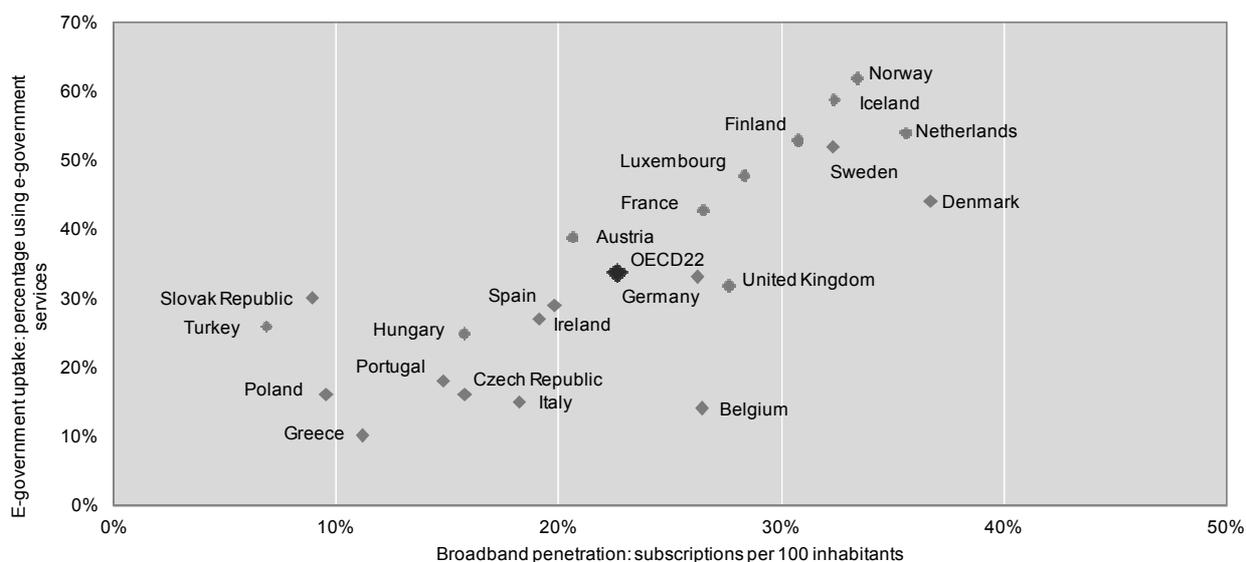
*The public sector also faces an innovation imperative.*

73. Demographic pressures, burgeoning demand, higher expectations and ever tighter fiscal constraints make the public sector seek innovative solutions to enhance productivity, contain costs and boost public satisfaction. The “innovation imperative” is therefore strong for the public sector itself. Comprehensive innovation strategies are needed for key public services, such as education or health, as are management practices and human resources policies that are conducive to innovation. Communities of practice and other networks should be encouraged to diffuse best practices, including to sub-national authorities, as these are often responsible for service delivery. Involving users and citizens in policy making and service delivery can achieve more innovation in the public sector.

*Data systems can inform policy ....*

74. Data systems that allow for linking outcomes to resources can support innovation in the public sector and inform policy making (Figure 8). A one-stop shop for government services and an initial focus on areas with a strong need for and value in improved government services can help make the transition to more user-focused and transparent government.

**Figure 8. Relation between broadband penetration and citizen uptake of e-government services, 2008**



Source: OECD (2009), *Government at a Glance 2009*, OECD, Paris.

*... and public-private partnerships are an effective instrument for innovation.*

75. Public-private partnerships based on established good practices, such as affordability, value for money, risk sharing, competition and transparency, can help strengthen public-sector innovation. The public sector needs to have sufficient capacity to create, manage and evaluate such partnerships.

### **Focus the innovation engine on meeting global and social challenges**

*Innovation helps to tackle global and social challenges.*

76. Innovation offers a means of addressing global and social challenges. For many of these challenges, market failures – including the simple absence of a market – limit investment and the development and deployment of products and services. A mix of policy instruments is necessary to reach sustainable solutions.

### **Foster international co-operation**

*Addressing global challenges requires improved international co-operation and commonly agreed principles for governance, ...*

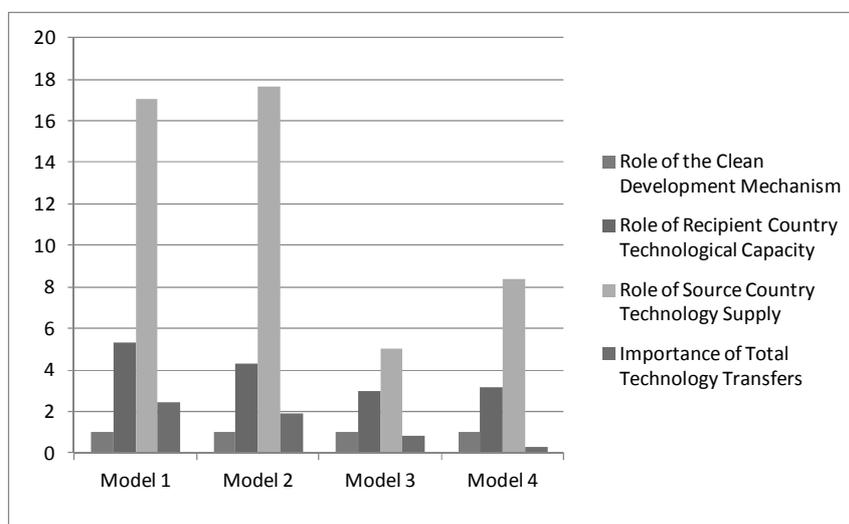
77. Global challenges need to be addressed collectively at international level through the development of comprehensive solutions and bilateral and multilateral co-operation. Proven co-operation strategies include joint investment in basic and pre-competitive research; mapping of R&D needs; technology transfer initiatives; and scholarships and fellowships for international researchers and students. Yet the current global challenges require more concerted approaches to accelerate technology development and diffusion and bring innovative products to the market. A new model for the governance of multilateral co-operation

... new approaches to international technology transfer ...

on international science, technology and innovation to meet these challenges is called for. It should focus on setting priorities for work, funding and institutional arrangements to support that work, and procedures to ensure access to knowledge, transfer of technology and capacity building, as well as to make innovations available for widespread use. The OECD, in co-operation with non-members, is working to bring forward agreed principles for such governance.

78. Diffusion of innovation is essential for addressing many global and social challenges. New approaches to technology transfer are needed. This calls for removing trade barriers that limit technology transfer across borders and developing mechanisms that enhance technology transfer and the development of knowledge markets (e.g. voluntary patent pools and other collaborative mechanisms for reducing transaction costs to access intellectual property). To take advantage of these technologies, an absorptive capacity must be in place. Multilateral agreements, such as the United Nations Clean Development Mechanism (CDM), can also be used to encourage technology transfer and to achieve public objectives at least cost. Ongoing OECD work finds that host country involvement in the CDM has encouraged the transfer of climate change mitigation technologies, although factors such as domestic absorptive capacity play a predominant role (Figure 9). Academic partnerships, cross-border higher education and scientific co-operation also facilitate technology transfer and lead to spillovers in the local innovation system.

**Figure 9. What is driving transfer? The case of wind power**



Source: OECD (2010), *The Invention and Transfer of Environmental Technologies*, OECD, Paris.

... and improved financing mechanisms.

79. New financing mechanisms can be used to provide incentives for global and local innovations that address global challenges. New modes of financing and managing innovation borrowed from the venture capital sector are being used by philanthropies and foundations to increase funding for research projects that address global challenges. International public-private partnerships can also be used by governments to address financing gaps in the areas of infrastructure, research or technology development.

*Platforms and forums can support the mobilisation of innovation ...*

80. International technology platforms and consortia that bring together firms and national governments can help address issues such as standards setting and technological deployment which arise when developing solutions for technologies that cross markets and borders.

*... and should give due attention to new actors, such as philanthropic organisations.*

81. Such approaches should involve the private sector, civil society, non-governmental organisations, philanthropic organisations and other stakeholders. Involving stakeholders will help improve the prioritisation and delivery of science and innovation to address global challenges.

***Tackle key challenges through innovation: climate change, health and food security***

*Getting prices right will help the development and diffusion of green technologies.*

82. Climate change is a global challenge that can only be addressed effectively through massive innovation. Pricing of environmental externalities, such as carbon emissions, will be an important trigger for the development and diffusion of green technologies and innovations. Tax policies, standards or other economic instruments can provide such a signal and can foster markets for innovation, as can the removal of environmentally harmful subsidies. At the same time, investment in long-term research and innovation will be needed to develop breakthrough technologies that private initiative alone will not undertake. Government will need to take the lead in areas that are too risky and uncertain for firms through investment in public research and well-designed support for pre-competitive research in the private sector. Fostering growth of new firms will be essential, as they are often the source of the most radical innovations.

*For global health, breakthroughs in science need to be aligned with supportive demand-side measures.*

83. Breakthroughs in science and in the organisation of innovation also offer opportunities to address challenges such as global health. Scientific discoveries, the growing availability of data, and the rapid development of new techniques in drug design and delivery (so-called personalised medicine) provide the beginnings of the technology push that can help address unmet needs. Innovative approaches based on inter-firm collaboration, access to and use of intellectual property, along with new financing mechanisms, may lead to a lower-cost approach to innovation in health care, which could be applied to health innovation more generally.

*Greater food security can also benefit from stronger innovation.*

84. Innovation is necessary to address global food security as well as to raise productivity and strengthen world agricultural supply. Investments in R&D, technology transfer and extension services, particularly in less developed economies, could do much to increase productivity and output. The use of new technologies also offers the potential to improve productivity, to enhance the attributes of crops destined for food or non-food uses, and to augment the resilience of crops to stress such as drought.

*Policy signals should be predictable and provide long-term incentives.*

85. Since many of the solutions needed to meet challenges such as climate change and global health involve significant up-front investments, it is important for potential innovators (and adopters) to face a credible long-term policy horizon if they are to bear the risk of undertaking such investments. Complementary measures are needed to develop stable and transparent regulatory frameworks that facilitate long-term planning, provide sufficient incentives for risk-taking investment, and promote market access for goods and services based on innovative technologies.

*Policies should be flexible and leave the choice of technology to firms.*

86. Policies should allow the private sector to identify the most promising means of addressing global problems through innovation. A flexible policy regime can encourage innovators to identify the most innovative technologies and solutions and adopters to invest in cost-effective technologies.

*They should target the policy objective as directly as possible.*

87. Where possible, policies should focus directly on solutions to the problems themselves, rather than some indirect “proxy”. For instance, in addressing climate change, a tax on carbon will be more effective for inducing an optimal innovation path than a tax on fuel or electricity use.

*An effective policy mix is essential to harness innovation to meet major challenges.*

88. Global challenges are by nature large and complex. They cannot be addressed by any one nation alone nor solved by any single policy intervention. They require an effective mix of demand and supply policies across the innovation cycle. The OECD stands ready to continue to work with members and non-members to develop, monitor and assess policy mixes to meet these most immediate societal challenges.

### ***Bridge the gap in economic development through innovation***

*Low-income countries face difficulties for using innovation to strengthen development ...*

89. Low-income countries face specific challenges for making innovation the source of economic development, such as poor framework conditions and low human and social capital. They should therefore be supported in strengthening their framework conditions and educational attainment. Improving rural productivity requires significant investments in basic infrastructure, including transport, rural energy and irrigation.

*... and should focus on fostering entrepreneurship, transforming agriculture and adding value.*

90. Low-income countries should receive support for modernising agriculture through a locally adapted approach in which entrepreneurship, agricultural productivity, and value addition drive poverty reduction and green growth. This entails linking research, university teaching, training, extension work, production, processing, packaging, safety standards, infrastructure, distribution systems, marketing and exports in value chains. Policies should take account of the role of women as drivers of growth in these economies and of the role of the informal economy.

*Modern communication technologies can support development.*

91. Policies should also urgently address low-income countries’ need for affordable communications services for individuals and broadband Internet connectivity for centres of learning, such as universities and technical colleges. ICT can also play a transformative role in fostering efficiency and transparency. Good land registration systems based on digital technology and mobile banking that secures financial transactions can boost investments in agriculture and businesses.

Improving technology transfer and strengthening institutional and policy foundations, as discussed above, would help accelerate the transfer of ICT technology to low-income countries.

**Policy coherence, good governance of policies and an improved measurement framework for innovation are essential**

*Innovation performance depends on how policies are combined and managed.*

92. A whole-of-government approach to policies for innovation is needed to encourage innovation in its many forms. It requires stable platforms for co-ordinating actions, policies with a medium- and long-term perspective, and attention from policy makers at the highest level. It also calls for coherence and complementarities between the local, regional, national and international levels.

*Achieving coherence is a challenge ...*

93. Achieving coherence and co-ordination is difficult. Coherence involves co-ordination of simultaneous policy actions and consideration of possible interaction with policies with other objectives. Supporting the growth of young dynamic firms, for example, requires close co-ordination of innovation and entrepreneurship policies. Likewise, closer integration of policies to foster innovation and a cleaner environment can help guide economies towards greater sustainability. However, simply developing additional policies will not improve coherence; existing policies may have to be reviewed, adjusted or phased out.

*... but compartmentalisation can be reduced through effective use of the budget process.*

94. Yet, policies for innovation often remain compartmentalised in different departments and agencies. This can create obstacles to co-operation and lead to a proliferation of innovation policies that are duplicative and wasteful. The budget process, as one of government's main decision-making tools, can help lead to effective innovation policies. Multi-year budgeting can help develop a long-term vision for innovation and secure funds on a multi-year basis. Performance budgeting can help position the policy goals and costs of innovation with respect to other policy goals of government.

*Policy development requires the involvement of stakeholders.*

95. The growing range of stakeholders in the innovation process and the growing impact of innovation on society increasingly require the involvement of stakeholders in shaping policies for innovation. Social well-being is an explicit goal – and not simply a consequence – of innovation. Government can work to remove barriers to full participation by the public and private sectors and other stakeholders in the development of innovative solutions to social problems and thus help to develop a shared vision and make policies more effective in meeting social goals.

*Innovation has a strong local dimension ...*

96. The innovation process has a strong local dimension. Knowledge includes an important tacit component that cannot be easily codified and therefore requires direct interaction, on-the-job learning and workers' mobility. Moreover, the high degree of uncertainty surrounding innovation activity may be reduced by the exchange of information among firms. As recent experience by both national and regional authorities has shown, there is scope to develop regional innovation policies that can capture positive local externalities. This may involve improving the efficiency with which partners interact, sharing knowledge and systematising the relationships between actors.

*... and regional policies play a growing role ...*

97. The growing importance of regions must be taken into account when designing the governance system. In many countries, regions have gained more control over policy as resources have been devolved to subnational authorities, with the objective to fully exploit the local interactions that affect the innovation process. In that context, regional policy makers are often better placed than their national counterparts to understand the local landscape and tailor interventions accordingly. Innovation agendas have been developed at the sub-national level, focusing notably on regional clusters and capability building among knowledge producers. Moreover, other factors driving innovation, such as linkages between research and industry and the promotion of entrepreneurship, also involve important roles for regional and local policies.

*... leading to the need for close cooperation and alignment with national policies.*

98. National policy should therefore set the right framework conditions for regional actors to foster innovation adapted to their own context and to build on local strengths. Regional policies can help nurture regional clusters and build capability among knowledge producers. They may be better placed than national policies to understand local conditions and tailor interventions accordingly. Regional policies may help capture positive externalities by improving the efficiency with which partners interact. National innovation policies may need to be adapted for regions that are not R&D-intensive hot spots. However, while aligning national and regional priorities is critical, regions also need room to experiment.

*Evaluation of policies can help improve their relevance and impact ...*

99. Evaluation of policies and practices is essential to enhance the effectiveness and efficiency of policies to foster innovation and deliver social welfare. Effective evaluation is also crucial for the legitimacy and credibility of government intervention in innovation processes. Improved evaluation approaches and methods are needed to capture the broadening of innovation, as is better feedback of evaluation into the policy-making process.

*... as better evidence is a necessary underpinning of innovation policies.*

100. Improving measures of innovation is essential for policy making and evaluation and for promoting innovation in businesses, the public sector and society at large. However, current innovation indicators are too focused on the inputs of the innovation process rather than on its outcomes, and aggregate numbers or indices do not adequately reflect the diversity of innovation actors and processes and the links among them. The OECD and the research community have worked to develop a new set of indicators to explore a notion of innovation that goes beyond R&D and to ascertain its impact on economic and social performance. Building on half a century of indicator development at the OECD, *Measuring Innovation: A New Perspective* provides a wide range of indicators for evidence-based policy making and sets out a detailed measurement agenda for innovation, summarised in Box 3. Continued efforts are needed to take this work forward and to adapt the measurement agenda to experience at the national and international level.

**Box 3: A measurement agenda for innovation: key actions**

A number of policy issues – the role of broader (beyond R&D) innovation, the growing importance of the public sector in innovation and better assessment of the economic impact of innovation to name but a few – require improved measurement. The project has engaged the international community and advanced the measurement agenda, but work remains:

**1. Improve the measurement of broader innovation and its link to macroeconomic performance.**

Science, technology and innovation surveys need to be redesigned to take a broader view of innovation and improved measurements are needed to link science, technology and innovation policies to economic growth.

**2. Invest in a high quality and comprehensive data infrastructure to measure the determinants and impacts of innovation.**

Sound policy advice needs to rely on a high quality and comprehensive data infrastructure, including at the sub-national level. The backbone of such infrastructure is a high quality business register. Linking different data sets and exploiting the potential of administrative records will improve understanding and reduce respondent burden.

**3. Recognise the role of innovation in the public sector and promote its measurement.**

There is need to account for the use of public funds, measure the efficiency of producing and delivering public policies and services, and improve learning outcomes and the quality of the provision of public services via innovation.

**4. Promote the design of new statistical methods and interdisciplinary approaches to data collection.**

Design of policies for innovation needs to take into account the characteristics of technologies, people and locations, as well as linkages and flows among them. New methods of analysis that are interdisciplinary in nature are necessary to understand innovative behaviour, its determinants and its impacts at the level of the individual, firm and organisation.

**5. Promote the measurement of innovation for social goals and of social impacts of innovation.**

The current measurement framework fails to measure the social impacts of innovation. The development of measures that provide an assessment of the impact of innovations on well-being, or their contributions to achieving social goals, needs to be promoted. This includes better measurement of the people dimension of innovation.

**The way forward – innovation to strengthen growth and address global and social challenges**

*Fostering innovation calls for developing a strategic approach ...*

101. Now more than ever, a strategic approach to fostering innovation is needed to achieve the core objectives of public policy. As countries emerge from the downturn, and with other sources of growth declining in importance and global challenges mounting, innovation needs to be harnessed more effectively.

*... adapted to different contexts and settings.*

102. The OECD Innovation Strategy offers a broad, system-wide approach to bringing together policies that help drive innovation in a mutually supportive manner. Together, the five priorities outlined above can help underpin the development of national and collective strategies for policies that will make innovation work for people and help meet the major challenges of the 21<sup>st</sup> century. They can be applied in different contexts and settings and take specific strengths and needs into account.

*It requires a concerted effort to bridge disciplines, technologies and organisational structures ...*

103. The broad concept of innovation embraced in this report emphasises the need for reaching across the borders of institutions, sectors, fields of training, academic disciplines and countries. This emphasis on building bridges diverges from the many innovation policies that are vertical in nature and target a particular field, sector, technology or locale. This broader vision of innovation necessitates concerted efforts to create a better match between supply side inputs and the demand side, including the role of markets, and to meet the expectation of consumers and society at large.

*... through country-specific assessments, tools and policies.*

104. The OECD Innovation Strategy recognises that countries' policy challenges differ, depending on their economic structure, level of development, culture and institutions. Its message is that a mobilising vision – and the ambition to achieve it through policy coherence and effective co-ordination – can help governments around the world to use innovation as a tool to improve economic performance, address societal challenges and enhance welfare. This requires both horizontal and vertical policy co-ordination. With the right set of policies in place, innovation will result in greater well-being at both the national and global levels.

*Policy coherence is essential to reap the benefits of innovation locally, regionally and nationally, as well as at global level.*

105. Policy coherence is also needed so that countries can capture value from innovation at the national, regional and local levels. In a highly interconnected global economy, firms and governments will need to make choices and establish priorities for areas in which they can achieve excellence and critical mass. Local strengths, such as strong human capital, knowledge institutions and networks, well-developed local services, social factors and job opportunities, are the key to attracting firms, including multinational firms, and talent to specific locations and countries and to developing local clusters of activity. These are the foundation on which collaboration with other firms and countries can be built, and strategic and selective choices have to be made.

*As innovation becomes mainstream economic policy, a number of areas need greater emphasis in the overall policy mix.*

106. In this broader approach to innovation, it is particularly important to balance policies aimed at the creation of new knowledge and innovations with those aimed at fostering its uptake and diffusion in the economy. Policy actions also need to reflect the changing nature of innovation. This implies an emphasis on the following areas:

- A more strategic focus on the role of policies for innovation in delivering stronger, cleaner and fairer growth.
- Broadening policies to foster innovation beyond science and technology in recognition of the fact that innovation involves a wide range of investments in intangible assets and actors.
- Education and training policies adapted to the needs of society today to empower people throughout society to be creative, engage in innovation and benefit from its outcomes.
- Greater policy attention to the creation and growth of new firms and their role in creating breakthrough innovations and new jobs.
- Improved mechanisms to foster the diffusion and application of knowledge through well-functioning networks and markets.
- New approaches and governance mechanisms for international co-operation in science and technology to help address global challenges and share costs and risks.
- Frameworks for measuring the broader, more networked concept of innovation and its impacts to guide policy making.

*Some aspects of policies for innovation will require further consideration.*

107. This system-wide approach elicits many questions, and further comparative analysis is needed to better understand the ongoing shifts in innovation processes and how policy can best respond. In particular, efforts are needed to address some of the tensions between certain framework conditions and targeted policies for innovation. For example, as open innovation models proliferate and lead to more collaboration by firms, opportunities arise for anti-competitive collusion that can reduce incentives to innovate. Efforts to engage in demand-led innovation must avoid protectionism and preserve competition. In addition, the governance of multilateral co-operation on innovation will require increased attention as the international community seeks collective solutions to global problems. The OECD will continue to explore and foster debate in these areas in the coming months and years.

### ***Implementing the OECD Innovation Strategy***

*Implementing the Strategy will benefit from monitoring and peer learning, ...*

108. The OECD stands ready to help governments and international instances to use the Innovation Strategy to design their approaches to finding national and global solutions. This work will also contribute to the OECD's Green Growth Strategy, requested by Ministers in 2009, and the OECD Project on Measuring the Progress of Societies. Implementing the Strategy will be an evolving process and will benefit from monitoring, peer review and the exchange of experiences and good policy practices.

*... from operational advice and indicators ...*

109. In the coming months, the OECD will be developing a Policy Handbook to provide operational advice and guidance to countries as they seek to implement an innovation strategy. It has also produced a compendium of indicators (*Measuring Innovation: A New Perspective*) that may help countries assess their performance and monitor the implementation of innovation policies. The construction of robust innovation indicators is a long-term endeavour which needs to continue and be supported at national and international level.

*... and from continuing dialogue with all the actors involved in developing and implementing policies for innovation.*

110. The development of the OECD Innovation Strategy has benefited from consultations with policy makers and stakeholders in national capitals. The OECD will continue to support a dialogue within governments, among various actors and between countries in the area of innovation.