

# OECD Science, Technology and Industry Outlook 2012 Highlights

**S**hort-term shocks – linked to the economic crisis – and long-term shocks – environmental, demographic and societal – have put OECD economies before unprecedented challenges. Under extremely stringent budgetary constraints, governments are mobilising all policy domains to design appropriate responses for reaching strong and sustainable growth. They must seize the opportunities offered by the Internet and global markets, as well as mobilise the main assets of their countries – human capital, knowledge capital, and creativity. In this agenda, innovation policies are given a pivotal role, which they can fulfill only if they adapt to this new context: they need relevance, coherence and inclusiveness in order to achieve efficiency and effectiveness.

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## *Innovation in times of crisis*

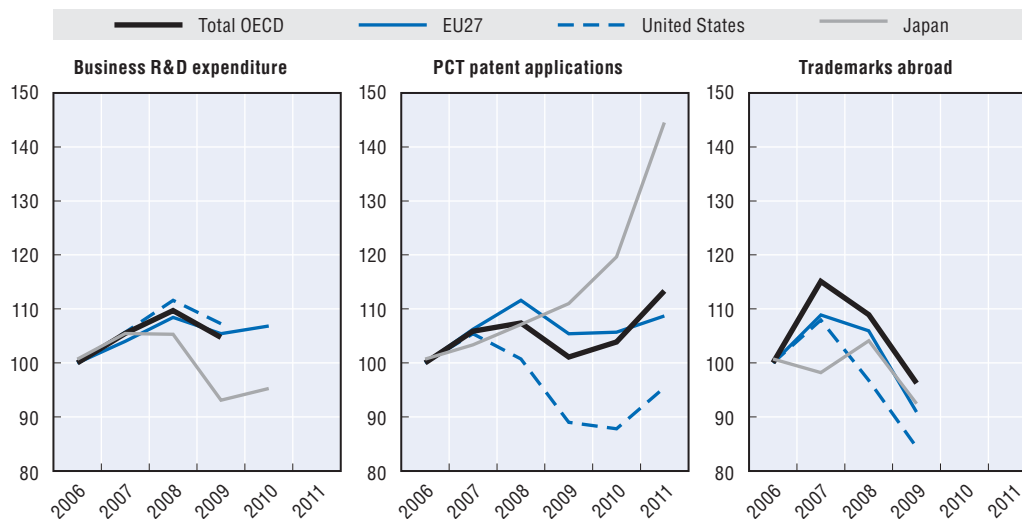
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The economic crisis which started in 2008 has had a significant impact on science, technology, innovation (STI) domains and policies. It has accelerated a number of trends and magnified certain challenges, most of which had already appeared prior to 2008. A re-examination of STI policies has therefore become more urgent. In this new environment some countries have adapted or have begun to adapt, while others have found it difficult to evolve. As a result, the gap between countries that grow and innovate and those that do not has been widening.

The global economic crisis immediately had a strong negative impact on innovation worldwide (Figure 1). Total OECD-area business expenditure on research and development (R&D) declined by a record 4.5% in 2009; it declined across all major OECD R&D spenders except Korea and France. In 2010 the recovery that occurred in some countries did not always imply a return to pre-2009 R&D levels. This pattern, a dip followed by partial recovery, is confirmed by indicators such as patents and trademarks. Among the countries most active in innovation, there is a striking contrast between Sweden and Finland, which have experienced a drop in terms of R&D and patents, and Korea, which has continued its fast, steady expansion.

Figure 1. **The global economic crisis had a strong negative impact on innovation worldwide**

Business R&D expenditure, PCT patent applications and trademarks abroad (index 2006 = 100), 2006-11



Source: OECD, Main Science, Technology Indicators (MSTI) Database, June 2012 and World Intellectual Property Organisation (WIPO), Statistics on the PCT system, July 2012.

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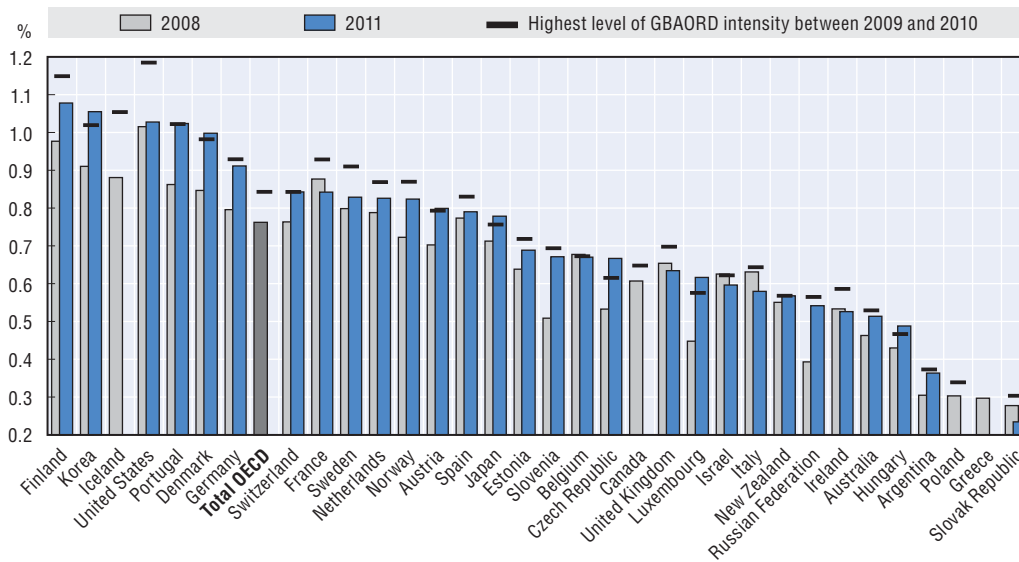
In view of current economic conditions and the rather uncertain outlook, it is likely that in most OECD countries, notably those most strongly affected by the crisis (e.g. some southern and eastern European countries), growth in business R&D expenditure will be quite sluggish in the foreseeable future. In countries with relatively solid framework conditions prior to the crisis and which have proved quite resilient in terms of economic growth (such as those of northern Europe and Germany), innovation activities might follow a more positive path. In countries such as France, Japan, the United Kingdom and the United States, however, the perspectives for both economic growth and innovation are more uncertain.

In 2009, the initial shock affected all categories of firms, but while the innovative activities of large multinationals, especially those in high-technology sectors, were back on track in 2010, innovative entrepreneurship has not yet returned to pre-crisis levels. In 2011, both enterprise creation and venture capital investment were still well below pre-crisis levels. Following the dramatic rise in firm failures during the crisis, the renewal of industry and the corresponding reallocation of resources have yet to make significant progress toward enhancing overall economic performance.

Government funding temporarily surged sharply in 2009 in many countries, as innovation was an important component of recovery packages (Figure 2). Government budget appropriations or outlays for R&D (GBAORD) increased by about 9% in the OECD area, with most going to infrastructure investment and to businesses (credit guarantees for small firms, refunds of R&D tax credits, public procurement, etc.). As this partly compensated the reduction in business expenditure, the decline in OECD total R&D expenditure in 2009 was not as large as it would have been otherwise. However, in 2010 and 2011, as governments' budgetary constraints became more severe, many countries substantially moderated or reduced their R&D expenditure (OECD GBAORD declined by about 4% in 2010).

Figure 2. **R&D and innovation have been an important component of recovery packages**

Government budget appropriations or outlays for R&D (GBAORD) as a % of GDP, between 2008 and 2011



Note: Countries are ranked by descending order of GBAORD intensity in the last year for which data are available.

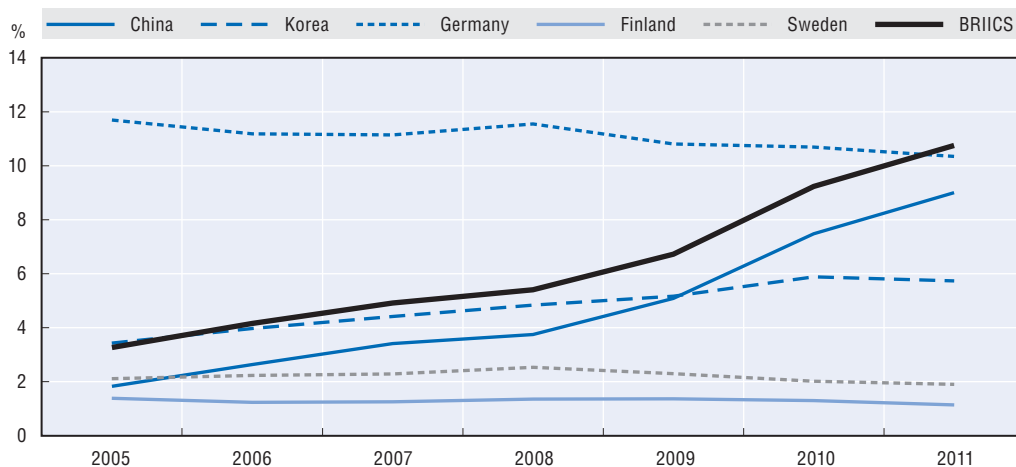
Source: OECD, Research and Development (RDS) Database, June 2012.

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While the crisis triggered stagnation or decline in innovative activities in OECD countries, it did not have that effect in some emerging countries. China still had high GDP growth and a steady increase in innovation activities, as business R&D increased by 26% in 2009 (Figure 3). As a result, China's share in global R&D, which climbed from 7% in 2004 to 10.5% in 2008, jumped to 13% in 2009; the crisis accelerated an existing trend. At the same time, developing countries such as India and Brazil are putting innovation higher on their policy agenda.

Figure 3. **China still had a steady increase in innovation activities**

Share in world PCT patent applications, selected countries, 2005-11



Note: Counts are based on the international filing date and country of residence of the first named applicant. BRICS include Brazil, the Russian Federation, India, Indonesia, the People's Republic of China and South Africa.

Source: World Intellectual Property Organisation (WIPO), Statistics on the PCT system, July 2012.

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### *The changing context of STI policies*

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The economic crisis has affected the innovation policy agenda both in terms of objectives and instruments. Rather than leading to new objectives or instruments, however, it has changed the balance of those already in place, generally with a view to maximising their impact on economic growth and saving resources. More broadly, the current context has intensified tendencies which were already at work before: innovation policies have to be relevant (to address economic or societal goals), coherent (with each other and with other policies), and inclusive (in terms of scope and of the concerned actors).

More than ever, restoring growth and competitiveness is the main objective of innovation policies. OECD countries need more growth, not least to address the persistent sovereign debt crisis and to tackle unemployment. In knowledge-based economies innovation is a major driver of growth. Because emerging countries increasingly challenge developed countries on knowledge-intensive segments of markets, developed countries need to climb the value added ladder. This calls for innovation.

Government budgets are under pressure, as the public debt crisis has shown that market actors are reluctant to fund government deficits further. Savings need to be found, and in most countries STI budgets are not exempt from cuts. Government action must become more efficient and more effective through a rebalancing of the instruments used, changes in governance, and more extensive use of *ex ante* and *ex post* evaluation.

Policies to address societal and environmental challenges are also increasing in importance. Urgent environmental challenges include addressing climate change, moving towards green growth and tackling natural disasters. Pressing societal objectives include ageing and health. Given stringent budgetary constraints, governments are realising that innovation is needed to address these challenges in the medium to long term.

A broader view of innovation towards service activities, beyond science and technology, is also progressively pervading policies, including those concerned with public services (e.g. in education).

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### *Addressing societal and global challenges*

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**Green growth and the environment:** Reducing global greenhouse gas (GHG) emissions and protecting environmental assets (clean air, water, biodiversity) call for innovation and the large-scale adoption of green technologies. Otherwise, it will be very difficult and very costly to sustain growth trajectories of the past decades while not depleting humanity's "green capital". OECD governments and emerging economies therefore view R&D activities and incentives for the diffusion and adoption of green technologies as a priority. Renewable energy programmes aim to reduce both GHG and dependency on oil (the price of which has recently risen sharply). Environment and energy feature high in the innovation strategy of most countries.

**Ageing and health:** Populations in most OECD countries, including in some emerging economies, are ageing, in many cases quite rapidly. An ageing workforce will likely constrain economic performance as well as increase strains on health services, long-term care systems and public finances. Science and technology, particularly ICT applications,

will play an important role in helping the elderly remain as healthy, autonomous and active as possible. The health challenge is not only confined to meeting the needs of an ageing population, but also to the needs of the whole society. Innovation is needed to develop the best science, deploy effective treatment, and contain the surging costs of treatment and equipment.

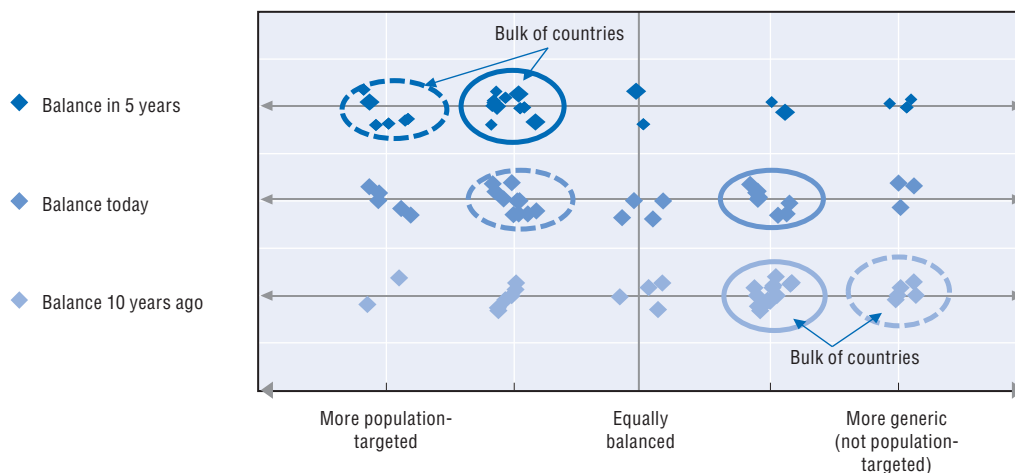
**Innovation for development:** Once considered the preserve of developed countries, innovation is now conducted by many emerging countries and their share of innovation worldwide is increasing. A world-class science base is not a condition for innovating. The notion of innovation encompasses much more than high technology; it includes lower technology, service industries and social innovation, all of which are needed at all levels of development. Innovation can contribute to addressing urgent challenges such as providing access to drinking water, eradicating diseases and reducing hunger. “Inclusive” innovations have a more direct impact, as they make new products more affordable for low- and medium-income households or allow the poor to modernize their often “informal” and low-productivity business.

### The changing instruments of innovation policies

Instead of a radical shift, the innovation policy mix has experienced a progressive evolution by which certain instruments are being used more widely while others have been receding. In a number of countries, targeted instruments are gaining importance as compared to generic ones: this is related to the emergence of important, targeted policy themes (e.g. new firms, social challenges), and to the budgetary crisis, which forces governments to concentrate spending under pressure (Figure 4).


**Figure 4. Targeted innovation policy instruments are gaining ground in OECD countries**

Changing balance in the policy mix for business R&D and innovation between population-targeted and generic instruments, based on country self-assessments, 2012



Note: Population-targeted refers to instruments targeted towards specific populations, e.g. types of firms, SMEs or new-technology-based firms, specific sectors, etc.

Source: Country responses to the OECD Science, Technology and Industry Outlook 2012 policy questionnaire.

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**Tax incentives:** The general trend has been to increase the availability and simplicity of use of R&D tax incentives, which are now available in more than two-thirds of OECD countries as well as in many non-OECD countries.

**Demand-side policies:** Demand-side innovation policies including public procurement of innovation, standards and regulations and lead markets and user-driven innovation initiatives – are gaining ground in OECD countries. They reflect the trend in innovation policy to address the full extent of the innovation system and cycle.

**Entrepreneurship:** Intensified financial and structural efforts (*e.g.* removal of administrative barriers) have been implemented by many countries in the context of the economic crisis.

**Clusters and “smart specialisation”:** Clusters bring together firms, higher education and research institutions, and other public and private entities to facilitate collaboration on complementary economic activities. “Smart specialisation” is a policy framework to help entrepreneurs and firms strengthen scientific, technological and industrial specialisation patterns while identifying and encouraging the emergence of new domains of economic and technological activity.

**Patents and IP markets:** Patent subject matter (software, genetic material, business methods) and patent quality have been much discussed over the past decade. Important reforms have been implemented and patent offices have focused on improving quality. Intellectual property (IP) markets seem to be on the rise including various types of transactions (licensing, sales) and actors (intermediaries, funds, etc.). Governments are involved through regulation (notably antitrust) and, in certain countries, through public patent funds.

**Information and communication technology (ICT) infrastructure:** Governments can facilitate the establishment of high-quality infrastructure (broadband networks) and ensure that its management (pricing, etc.) is conducive to adequate use.

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### *Raising the effectiveness of public sector research*

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**Commercialisation of public sector research:** This goal has taken on greater urgency in the aftermath of the economic crisis as public funding has become scarcer. A major tendency is the professionalisation and increasing scale of technology transfer bodies (through the regrouping of smaller ones). Spin-offs (*e.g.* in the context of incubators), contract research, and patenting and licensing remain the main instruments, together with mounting attention to open science.

**Open science:** As science becomes more commercialised, and as ICTs make access to knowledge technically easier, many governments want science to diffuse broadly and flow to society and the economy. This implies providing the necessary technical infrastructures (databases, etc.) and legal framework (IP).

**Internationalisation:** Ensuring the insertion of national actors into global knowledge networks is an important policy goal. Relevant instruments include a legal framework and financial incentives that encourage the mobility of researchers and international research co-operation to address global challenges.

**Management and funding:** The higher education sector in most countries continues to evolve towards a more decentralised mode of organisation, in which universities are endowed with autonomy and responsibility. This trend is consistent with a model in which research funding is based more on competitive grants than on institutional funding.

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### Strengthening the governance of innovation policies

The increasing variety of objectives, instruments and actors (regions, specialised agencies, public-private partnerships, etc.) requires new ways of co-ordinating innovation policies to ensure coherence of design and implementation and to maintain government control.

Recent changes in the governance of STI systems include the tendency to put specialised, partly autonomous agencies in charge of various missions (e.g. allocating funding to public research institutes and universities) and the emergence of regional policies that supplement national policies and boost cross-regional competition.

**National STI strategies** have been developed and implemented in many countries. They articulate the government's vision of STI's contribution to social and economic development and the corresponding investment and reform agendas.

**STI policy evaluation** has attracted policy attention recently because governments are devoting significant resources to R&D and innovation at a time of fiscal crisis. Many governments have consolidated evaluation frameworks, streamlined evaluation procedures (sometimes through the establishment of a single dedicated agency) or reinforced co-ordination of evaluation units. Some countries have worked to harmonise practices by defining common methodologies and consolidating indicators, and a few are building data infrastructures and expert communities.

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