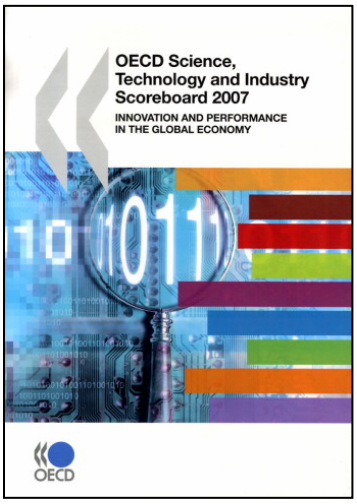
OECD MULTILINGUAL SUMMARIES



OECD Science, Technology and Industry: Scoreboard 2007 Edition

Summary in English

- The annual *Science, Technology and Industry Scoreboard* examines how OECD countries and key emerging economies are doing in science and technology, globalisation and industry.
- This year's edition shows that investment in research and development (R&D) is rising in OECD countries, but more slowly than in the late 1990s.
- The United States, Europe and Japan remain firmly at the forefront of world science, emerging economies are playing an increasing role, especially in high-technology industries.

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This eighth edition of the ***Science, Technology and Industry Scoreboard*** brings together the latest data and indicators on trends in knowledge, on globalisation and on its impact on economic performance in OECD and non-member economies. In this edition, the international examination broadens to include emerging countries, with a special focus on the BRICS (Brazil, Russia, India, China and South Africa). New data document trends in public support for knowledge creation and diffusion, and new indicators point to the changing landscape of countries' scientific specialisation and innovation performance. Information on emerging fields (biotechnology, nanotechnology, and the environment) reveals the increasing linkages between science and technology.

Investment in knowledge has grown at the same pace as GDP

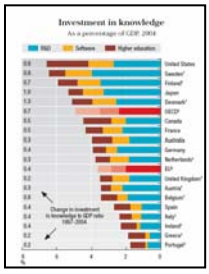
Since 2001, R&D expenditure in the OECD area has kept pace with the growth of GDP, at about 2.25% of overall GDP.

Investment in knowledge is the basis of innovation and technological progress. As measured by R&D expenditure, software and education, it continues to rise in most OECD economies. Across the OECD, however, R&D has grown more slowly than in the second half of the 1990s, owing in part to a readjustment of investment following the acceleration of the late 1990s and the slowdown of investment in R&D in the United States.

In both Japan and the EU, R&D intensity (R&D expenditure relative to GDP) picked up in 2005 to 3.3% and 1.7%, respectively, following a drop in 2004. In the United States, R&D intensity declined from a peak of 2.7% in 2001 to 2.6% in 2006, mainly owing to stronger growth in GDP than in the other main regions. In 2005 China became the third R&D spender worldwide (in purchasing power parity terms) after the United States and Japan, with growth of more than 18% a year in 2000-05.

The business enterprise sector accounts for the bulk of R&D in OECD countries in terms both of performance and of funding (at 63 and 68%, respectively, of the total), and, except in the United States, its share has risen over the past few years. Compared to 1995, the share of business-funded R&D in GDP in 2005 is much higher in Japan (2.5%), the United States (1.7%) and the EU (0.9%).

[Fig A.1.1] Investment in knowledge, as a percentage of GDP, 2004



Employment of HRST has expanded due notably to increases in female employment and expansion of the services sector

Nordic countries report the highest shares of R&D personnel and highly skilled workers in total employment. In OECD countries, employment of HRST continues to grow much faster than total employment in all countries, at an

average annual rate of 2.5% in the United States and 3.3% in the EU15. This expansion has been mainly driven by increases in female employment and the expansion of service industries (with a share of HRST in employment that is on average twice that of manufacturing).

Venture capital is a major source of funding for new technology-based firms and a decisive determinant of entrepreneurship and innovation. It represented about 0.12% of OECD-wide GDP in 2005, up from 0.10% in 2003. It was much higher in Nordic countries (and growing rapidly), but it still remains concentrated in the United Kingdom and the United States. In 2005, these two countries attracted half of all OECD venture capital.

Innovation policies: tax incentives and industry-university linkages

In 2006, 20 OECD countries offered tax relief for R&D compared to 12 in 1995

OECD countries' policy mix for fostering innovation is changing. In 2005, direct government funds financed an average of 7% of business R&D, down from 11% in 1995, with a shift away from public procurement (direct subsidies) and towards tax relief. In 2006, 20 OECD countries offered tax relief for business R&D, up from 12 in 1995 (18 in 2004), and most have tended to make it more generous over the years. Government revenue forgone as a result of R&D tax credits can be substantial. In 2006, they represented 23% of direct subsidies in the United States, 43% in France, twice the total amount of direct subsidies in the Netherlands and 1.2 and 1.3 times the amount in Ireland and Australia.

In most of OECD countries, university patenting is increasing

In order to stimulate technology transfer from universities to businesses, many OECD governments have encouraged universities to patent their inventions. OECD-wide between 1996-98 and 2002-04, the share of patents filed by universities has been stable. While decreasing slightly, to about 7%, in the countries that pioneered such policies (Australia, Canada and the United States), the share has increased markedly in Japan and the European Union, notably in France and in Germany, although levels remain modest (1.5% in Japan, 3% in the EU, but more than 5% in France).

S&T and innovation performance: the rise of new players

China ranks sixth worldwide in terms of publications and has raised its share in triadic patents from close to zero in 1995 to 0.8% in 2005

The United States, Europe and Japan remain at the forefront of world science with 30, 33 and 8%, respectively, of total scientific publications; they also lead in

patenting of important inventions, as measured by triadic patents (each had 30% of the total in 2005). In per capita terms, however, Switzerland takes first place, followed by the Nordic countries. In terms of specialisation, patent data show that emerging economies (India, China, Israel, Singapore) and the United States focus their innovative efforts on high-technology industries (computers, pharmaceuticals) while continental Europe concentrates on medium-high-technology industries (automobiles, chemicals).

After the explosion of the late 1990s, steadier diffusion of ICT

Technological advances and the diffusion and use of ICT have boosted economic change over the past decade. ICT has become a strategic enabler of companies' organisational and technological innovation.

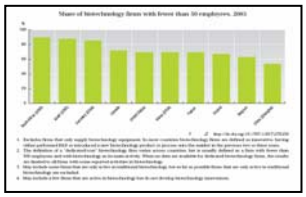
In 25 OECD countries over 89% of businesses use the Internet

ICT is diffusing at a more regular pace than in the late 1990s and early 2000s, as confirmed by Internet use in households and e-commerce, although the level of the latter remains modest. The penetration of broadband among households has progressed rapidly over the past three or four years in all countries but penetration rates vary. For households, Korea, Japan and the Nordic countries feature rates of 50 to 80%, while those for Italy and Ireland are around 10 to 15%. The take-up of broadband depends on computer penetration, but also on the level of competition and availability of service. Lastly, business use of the Internet has become fairly standard in OECD countries: in 25 countries more than 89% of businesses with ten or more employees have access to the Internet and over half have their own website.

The emergence of biotechnology, nanotechnology and environmental technologies

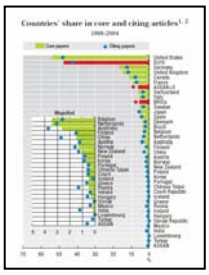
Certain fields deserve special scrutiny, in view of their current or expected impact on society and the economy, notably in terms of industrial innovation and applications, health and the environment. The United States has the most biotechnology firms (close to 2 200), followed by Japan and France (around 800 each). In most countries, biotechnology represents 2 to 6% of business R&D but the share is higher in the United States, Switzerland and Canada, and above all in some smaller countries where it exceeds 20% (Denmark, New Zealand, Iceland). In the ten reporting countries, most biotechnology firms are active in health (45%), followed by agro-food and industry-environmental applications (around 25% each).

[Fig F.1.2] Share of biotechnology firms with fewer than 50 employees, 2003



While the United States and Japan take the lead in biotechnology and nanotechnology, the EU leads the way in environment-related technology

[Fig. F.9.1] Countries' share in core and citing articles 1999 – 2004

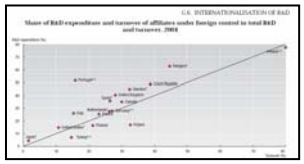


The United States and Japan have a comparative advantage in biotechnology and nanotechnology patenting and in the corresponding scientific fields, while the EU is the world leader in environment-related technologies (solid waste, renewable energy and motor vehicle abatement), with Germany playing a very active role. Japan is second to the EU in all three environmental technology fields. However, while patenting in renewable energy and motor vehicle abatement has been increasing rapidly since the mid-1990s, patenting in solid waste technologies has declined.

Innovation is an increasingly collective and international endeavour

Since the early 1990s cross-border ownership of inventions has expanded from 11 to 16% of total patented inventions

[Fig. G.6.1] Share of R&D expenditure and turnover of affiliates under foreign control in total R&D and turnover, 2004



There has recently been a sharp rise in the globalisation of scientific and technological activities, including research. The increased flexibility in handling cross-border R&D projects (owing to ICT), the rise of R&D costs, and major policy changes (such as stronger intellectual property rights or the tax treatment of R&D) have all favoured this trend. International co-authorship of scientific publications increased by a factor of three between 1995 and 2005. Cross-border co-operation on inventions (share of patents with co-inventors located in two or more countries) nearly doubled as a share of total inventions worldwide (from less than 4% to more than 7% between 1991-93 and 2001-03). In this configuration, EU countries interact most often with each other and are less globalised than the United States, while Japan and Korea are less internationalised overall.

In a majority of reporting countries, foreign affiliates' share of total expenditure on manufacturing R&D is now higher than their share in total manufacturing turnover

The surge in the internationalisation of research is corroborated by multinationals' recent patterns of investment. R&D performed abroad and by foreign affiliates represents on average well over 16% of total industrial R&D expenditure in the OECD area. Furthermore, the average R&D intensity of affiliates under foreign control is higher than the R&D intensity of domestically controlled firms in most countries. This is the case in Japan, Sweden, the United States and the United Kingdom. This tendency confirms the increasingly global

dispersion of R&D activities as they move closer to markets and to sources of knowledge.

Value chains as a centrepiece of globalisation

As reflected in available indicators the internationalisation of economic activity – trade, investment, technology trade – is trending upwards. Investment flows, notably portfolio investment, increased rapidly in 2003-05 and represented the equivalent of 12% of OECD GDP. Trade in goods represented 19% of OECD GDP in 2001-05, while trade in services represented about 5%, a significant increase over the early 1990s.

For its part, foreign direct investment has progressed steadily in most countries since the mid-1990s. Among large OECD countries, it represents a greater share of GDP in the United Kingdom and in France than in Germany, the United States and Japan. In all countries, firms under foreign control have a smaller share in employment than in turnover, as they are more capital-intensive than firms under domestic control, and their share in exports is higher as they usually serve the international more than the local market.

Knowledge and innovation leading productivity and trade

[Fig. I.5.1] Share of total gross value added, 2004
High and medium-high technology manufactures

GDP per capita is the most commonly used measure of welfare. It is the highest in the United States and most OECD countries are at 70-85% of US income levels. Differences in GDP per capita reflect a combination of labour productivity, measured as GDP per hour worked, and labour utilisation, measured as hours worked per capita. The latter largely reflects working time and conditions on the labour market (unemployment).

Productivity growth in the OECD area is increasingly dependent on ICT and on business services

In terms of productivity, several European countries have the highest levels (Belgium, Ireland, France, the Netherlands) but have much lower levels in terms of labour utilisation. From 0.3 to 0.7 percentage points of annual GDP growth in Australia, Denmark, Sweden, the United Kingdom and the United States over 1995-2005 were due to investment in ICT, which had a smaller impact in other countries. As the share of business services in the economy has increased, their contribution to productivity growth has also risen in most OECD countries since 2000, the major exceptions being Finland, Germany, Korea and Sweden.

Parallel to this evolution, the share of high and medium-high-technology manufacturing has declined over the past decade in most OECD countries. This is due in part to changes in global value chains (notably offshoring) which are helping to reconfigure industrial structures and trade. Yet high-technology industries, together with medium-high-technology industries (notably motor vehicles, chemicals and machinery and equipment), still represent just under 65% of OECD manufacturing trade.