

OECD SCIENCE, TECHNOLOGY AND INDUSTRY SCOREBOARD 2007

BRIEFING NOTE ON FRANCE

Innovation and performance in the global economy

Throughout the world, innovation and globalisation are the two major sources of countries' economic performance. They directly affect productivity, job creation and citizens' well-being, and they help make it possible to address global challenges such as health and the environment. As their role has taken on greater prominence, their characteristics have evolved and policies have had to adapt.

The eighth edition of the *OECD Science, Technology and Industry Scoreboard* explores recent developments in matters relating to science, technology, globalisation and industrial performance. It points to an increasing globalisation of science and technology activities encompassed by more stable trends in investment in knowledge. The pace of diffusion of information and communication technologies has become steadier than in the heady days of the late 1990s, notably in terms of broadband Internet access among households and adoption by businesses for e-commerce. Public policies that seek to foster innovation are being progressively reoriented, from subsidies and procurement to alternative instruments such as R&D tax relief and reinforcement of industry-science linkages.

R&D expenditure is declining in France

With 2.1% of its GDP on R&D in 2005, France ranks among the most intensive spenders in the EU (1.8%) after the Nordic countries (between 2.5 and 3.9%), Germany (2.5%) and Austria (2.4%), and just ahead of the United Kingdom (1.8%). However, global expenditure on R&D has risen in France only by about 1.2% a year since 2000, putting France among the last in the OECD ranking (the EU average is close to 3%).

The near stagnation of R&D in France over the past 5 years has been due to an absolute stagnation in business R&D and slow growth of government R&D. This makes France the last country but one in the OECD for business R&D growth over the 1995-2005 period.

In 2005, venture capital funding represented 0.08% of GDP in France; this figure is 0.11% for the EU, 0.06% in Germany, and 0.29% in the United Kingdom.

R&D is largely funded by government and benefits from generous forms of tax relief

Compared to many other countries, a large share of France's R&D (37.6%) is funded by the government. The corresponding ratio in 2005 was 30.5% in Germany, 32.8% in the United Kingdom, and 35.4% in the EU. Government funding of R&D to enterprises is more highly concentrated in large firms in France than in other countries except the United Kingdom: the share of small and medium sized firms is 12.8% only (against 21.9% in Germany, for instance).

Government funding of business research decreased in all countries between 1995 and 2005, but this decrease is the most pronounced in France where the share fell from 17% to 9% (in the EU the drop was from 11% to 8%).

Business funding of public R&D (higher education and governments sectors) was stable in France at 4.5% between 1995 and 2005, whereas it increased slightly in the European Union (from 6.1% to

6.4%) and more in Germany (from 6.0% to 8.3%), but it fell in the United Kingdom (from 6.6% to 6%), due notably to an increase in government funding.

The tax treatment of R&D is relatively generous in France (which ranks 6th in OECD in that regard, 1st among G7 countries). The cost to government (foregone revenue) was EUR 1 billion in 2005, slightly higher than in the United Kingdom, whereas in Germany R&D expenditures do not benefit from special tax relief.

Commercialisation of public research has become a central theme of innovation policies over the past decade. One form of commercialisation is patenting, which serves as a basis for licensing, creation of spin-offs, etc. In this regard, France has made impressive progress since the late 1990s. The share of universities (including CNRS and *Grandes Ecoles*, excluding CEA) in patents filed by French entities has grown from about 3% in 1996-1998 to more than 5% over the 2002-2004 period. Corresponding figures for the United Kingdom were 5.9% and 7.7%, and for Germany about 0.4% and 1.6% (the EU average has risen from 1.8% to 3.1%).

Research in the public sector in France is still less open to co-operation with small and medium-sized firms than in other countries. The share of SMEs declaring collaborating in innovation with higher education institutions in 2002-2004 was about 2.6% in **France** against 3.9% in the United Kingdom and 4.4% in Germany. The corresponding shares for large firms were 18.7%, 12.7% and 22.4% respectively.

A strong involvement in biotechnology

Compared with the other EU countries for which data are available, business-sector expenditures on biotechnology R&D are the second highest in France (after Germany), with USD PPP 1342 million. This corresponds to 5.7% of the total R&D expenditures (3.3% in Germany, 7% in the United States).

The majority of biotechnology firms are active in health (41% in France and in the United States, 65% in Germany), followed by agro-food applications (17% in France and 21% in Germany).

The increasing importance of HRST

The share of the relevant age cohort which graduates at doctoral level is 1.1% in **France**, against an EU average of 1.4% and a rate of 2.1% in Germany. The growth of tertiary level employment in 1998-2004 has been 4.2% a year, a rate similar to the EU average, but higher than the United Kingdom (3.7%) and Germany (1%). The growth rate was higher for women (4.5%), as in most OECD countries. With a share of HRST in total employment of 30.5%, slightly above the EU average (29.7%), France is between the United Kingdom (26.8%) and Germany (35.8%).

Like the United States, France has a high share of employed professional and technical immigrants on its territory (8.3%) and a low share of employed professional and technical expatriates in other OECD countries (2.6%). In both France and the United States, the high share of immigrants is due to a large contribution from persons born in non-OECD countries.

In terms of scholars working in the United States, France is second only to Germany among EU countries (3380 against 5117), ahead of the United Kingdom (3334) and Italy (2983).

France has the highest share in the EU, after Finland, of HRST in total employment in the manufacturing industry (26%), ahead of Germany (24.2%) and the United Kingdom (19%). In terms

of earnings, inequality between the tertiary-educated workers and those below upper secondary level, France is less unequal than Germany and the United Kingdom, although more unequal than the Nordic countries.

Overall innovation performance is modest

France's share in triadic families world-wide decreased between 1995 and 2005, as have the shares of Germany and, even more so, the United Kingdom. Korea, Japan and China have gained shares. France still applies for far fewer patents than Germany (less than half). The share of high and medium-high technology industries in patents issued to French inventors is similar to their share among German, British and EU inventors (around 85%).

France issued 4.6% of world-wide scientific publications in 2003, against 6.3% for Germany and 6.9% for the United Kingdom. In terms of "prominence" of scientific publications (citation rates), France ranks behind Germany and the United Kingdom, just above the European Union average, and far below Switzerland, the United States and most of the Nordic countries.

Over the 2002-2004 period, the share of product innovators among large firms was quite high (50.1%) in France (ranking 6th in the EU), but the rate of innovators among SMEs is much lower (14.8%), putting France among the lowest performers in the European Union (Germany is at 27.3%). However, French SMEs fare relatively better as process innovators, with a higher rate than German SMEs (17.8% against 15.4%). The relative weakness of French SMEs as compared with large firms applies to non-technological innovation as well. Overall, France ranks quite low for non-technological innovation, notably as compared with Germany.

Growing investment in ICT

In several OECD countries, ICT's share in total non-residential investment doubled between 1985 and 2000 but then started to decrease, following the burst of the dotcom bubble. ICT investment picked up a little in France from 2001 to 2002 and represented 16.4% of gross fixed capital formation in 2005 (this figure was 15.3% in Germany and 27.8% in the United States).

Software remains the fastest-growing component of ICT investment. Its share in non-residential investment was multiplied by 5.5 in France, 2 in Germany and 3 in Sweden between 1990 and 2005. Software's share in total investment was 11% in France, 7% in Germany, 10.7% in the United Kingdom and 14.5% in the United States.

Since 2001, the number of Internet subscribers has been increasing in France but efforts are still needed in order to reach the level of the leading countries. In 2005, there were 36 Internet subscribers per 100 inhabitants in Switzerland (against 21.2 in France, 26.7 in the United Kingdom, 33 in Germany).

On the other hand, the volume of Internet and other e-commerce sales transactions was amongst the highest in 2006 in France (16.7% of the total enterprise turnover), preceded by Denmark (17.5%) and followed by Germany (13.9%).

Highly internationalised research activity

The extent of internationalisation as reflected in foreign ownership of domestic inventions varies substantially across countries. For the 2001-2003 period, it represented over 50% in Luxembourg, 25.4% in France, 15.1% in Germany and 13.6% in the United States.

In the 2000s, like most OECD countries, France has become more strongly involved in cross-border innovative activity compared to the past decade. Domestic ownership abroad represents 20.7% in France, 12.9% in Germany, 34.1% in Belgium and 38.3% in the Netherlands.

In both these respects, and as with most European countries, France's main partners are the EU countries, followed by the United States.

Another significant indicator of S&T internationalisation is the share of patents with foreign co-inventors. Between the periods 1991-1993 and 2001-2003, this ratio doubled in France and reached 16.6% (12.3% in Germany, 16.6% in Sweden and 16.7% in the Netherlands).

Labour productivity is high, but it is slowing down

A country's labour productivity level is typically the most significant factor in determining differences in income. Labour productivity, measured as GDP per hour worked, was 1 percentage point higher in France than the United States in 2005 (+38 in Norway, +11 in Belgium, -6 in Germany and -15 in the United Kingdom). Since 2000, like most OECD countries, **France** has experienced a marked slowdown in labour productivity growth. In the first half of the 2000s, this figure was around 1.3% in Germany, 1.5% in France and 2% in the United Kingdom.

Technological effort is a critical determinant of productivity growth and international competitiveness. Of the larger OECD economies, except Germany, Japan and Korea, many could not maintain a strong and persistent presence in high and medium-high-technology manufacturing over the last decade. This reflects the continuing global shift of these activities towards non-OECD economies, including offshoring by multinational firms, and the increasing importance of service activities in many OECD countries. The share of gross value added in the high and medium-high-technology manufactures was 15.1% in Korea, 12.7% in Germany, 9.7% in Japan and only 5.6% in France.

As in most of the European countries, the share of medium-high and high technology manufactures in total exports was quite high in France in 2005 (22.4% and 39.8% respectively).