

## OECD SCIENCE, TECHNOLOGY AND INDUSTRY SCOREBOARD 2005

### BRIEFING NOTE FOR JAPAN

#### **Science, technology and innovation hold the key to stronger growth**

Science, technology and innovation have become key factors contributing to economic growth in both advanced and developing economies. A growing number of OECD countries are emphasising innovation and knowledge in their quest for stronger economic growth. This process is reinforced by rapid globalisation and the emergence of new international players outside the OECD area, notably China.

The 2005 *OECD Science, Technology and Industry Scoreboard* points to large cross-country differences in the extent to which OECD member countries are able to apply science, technology and innovation and foster stronger growth performance. It also points to large differences in the extent to which countries are able to attract and benefit from global knowledge flows. OECD data show that Japan is the least internationalised of the G7 countries, implying that it may not benefit from global knowledge flows.

#### **Japan continues to make an important contribution to knowledge creation in the OECD area ...**

OECD data show that **Japan** was the second largest spender on research and development (R&D) in the OECD area in 2003, with 114 billion USD, or just below 17% of the OECD total. This is behind the United States, which spent 285 billion USD. All European Union countries combined spent 211 billion USD and China spent 85 billion USD. **Japan** had the highest R&D intensity of the main OECD regions, of 3.2% of GDP in 2003, which is ahead of the United States (2.6%) and the EU (2.0%).

**Japan's** high R&D intensity is primarily due to strong business spending on R&D, where **Japan** ranks third in the OECD, just after Finland and Sweden. **Japan's** government R&D budget was below the OECD average as a percentage of GDP (around 0.7%), and trails government R&D budgets in the United States and France (around 1.2% of GDP). In recent years, **Japan's** budget for public R&D has risen more rapidly than the OECD average, growing at almost 6% from 1995-2003, although it has trailed US spending on public R&D.

**Japan's** contribution to scientific output as measured by articles accounts for less than 9% of the world total, which is well below Japan's contribution to global R&D or patenting. When scientific output is compared to population, **Japan** is below the OECD average, the only G7 country to be in that position.

#### **... but faces challenges in human resources for science and technology**

Science and engineering (S&E) degrees represent 23% of total new degrees awarded in OECD countries, 25% in **Japan**, 27% in the European Union and 16% in the United States. These percentages have declined in many countries since 1998. In **Japan**, only 13% of all S&E degrees are awarded to women, the lowest ratio in the OECD area, far below the European Union (33.4%) and the United States (35.2%).

In 2003, China had the second highest number of researchers in the world (862 000), behind the United States (1.3 million in 1999), but ahead of **Japan** (675 000) and Russia (487 000). Among the major

OECD regions, **Japan** had the highest number of researchers relative to total employment (10.4 per thousand), followed by the United States (9.3) and the European Union (5.8).

The vast majority of OECD countries are net beneficiaries of highly skilled migration. Migration streams converge massively towards four main settlement destinations: the United States with over 7.8 millions highly skilled expatriates, the European Union (4.7 millions), Canada (2 millions) and Australia (1.4 million). Over half of these skilled migrants come from outside the OECD area. **Japan**, together with Korea, is the OECD country with the lowest ratio of foreign highly skilled migrants in its workforce.

### **Japan is strong in patenting, but the least active in international co-operation**

**Japan** accounted for just under 25% of all triadic patents in 2001, compared to 34% for both the United States and the European Union (EU-25). **Japan's** contribution to global patenting is substantially above its contribution to global R&D efforts.

**Japan** accounted for only 12.3% of biotechnology patents filed at the European Patent Office in 2001, most of which originated from the United States (41.5%). The United States is more specialised in biotechnology patents than the European Union or **Japan**.

**Japan** is relatively specialised in ICT-related patents, however. The United States accounts for just under 29% of ICT patents filed at the European Patent Office in 2001, while **Japan** accounts for almost 22%.

**Japan** is the OECD country that is the least active in international co-operation in patenting. Less than 4% of domestic inventions in **Japan** are owned by foreigners, compared with over 12% in the United States, 13% in Germany, and 37.5% in the United Kingdom.

### **Japan has a high uptake of ICT, but is behind the leaders in the OECD area**

**Japan** has invested less in ICT than some countries, spending just under 3% of GDP in 2003. This is behind the United States, Australia and Korea, that spent about 4% of GDP, but ahead of France, Germany and Ireland, where ICT investment was below 2% of GDP.

E-mail is the most popular of the Internet's communication services, and is used by more than half the adult population in many OECD countries. More than 60% of adults in each of the Nordic countries use e-mail, as do between 56 and 60% of adults in Switzerland, Luxembourg, **Japan** and the United States.

**Japan** and the United States have good data on business-to-consumer e-commerce (B2C) sales. **Japan** shows increasing rates of growth, and US retail trade data reveal steady growth in retail e-commerce sales, with a nearly fourfold increase between the final quarter of 1999 and the first quarter of 2005.

There were close to 27 secure servers per 100 000 inhabitants across OECD countries in July 2004, up from 1.8 per 100 000 in July 1998. Countries with high levels were Iceland (86 per 100 000 inhabitants), the United States (68), Canada (48), New Zealand (41), Luxembourg and Australia (40). **Japan** was below the OECD average, with only 15 secure servers per 100 000 inhabitants.

Access to computers in households has increased significantly in recent years. **Japan ranked** fourth among OECD countries, with 78% of households having access to a computer in 2004. Iceland and Denmark led the way in 2004, with 86% and 79% of households, respectively, having access to a computer.

In almost all OECD countries, households with children are more likely to have Internet access at home and men are more likely than women to use the Internet. Adults in the Nordic countries are the highest users of online banking services, whereas adults in **Japan** and the United States are most likely to use the Internet for online shopping.

### **Japan is the OECD country with the lowest contribution of foreign-controlled affiliates**

In 2002, the share of foreign-controlled affiliates in total manufacturing turnover ranged from 75 % in Ireland to less than 3 % in **Japan**. In services, the share of the turnover of foreign affiliates in services ranged from almost 40% of total services turnover in Ireland to less than 1 % in **Japan**. In both manufacturing and services, **Japan** is the country with the lowest penetration of foreign affiliates. In comparison, over 20% of US manufacturing turnover was due to foreign affiliates, and almost 8% of services turnover.

Foreign affiliates also account for only for 3.8% of manufacturing R&D in **Japan**, which is substantially below the United States (18%), Germany (25.6%), France (22.3%), the United Kingdom (31.5%) and Canada (37.9%).

Foreign affiliates also made a negligible contribution to labour productivity growth in **Japan's** manufacturing sector, compared with almost a quarter of manufacturing productivity growth in the United States. In the Czech Republic and Sweden the bulk of productivity growth in manufacturing was due to foreign affiliates.

### **Japan's performance in knowledge-based sectors has deteriorated**

**Japan** continues to trail the United States in income and productivity levels. In 2004, its level of GDP per capita was 75% of the US level, and its level of GDP per hour worked was 73% of the US level.

**Japan** particularly trails in the services sector. Knowledge-intensive services account for only 16.5% of value added, which is far behind the United States, at 24.3%, or the United Kingdom, at 22.5%. The Japanese services sector has not contributed much to productivity growth in recent years, in contrast to Australia and the United States, where business services accounted for the bulk of productivity growth in recent years.

High- and medium-high technology industries accounted for 83% of **Japan's** manufacturing exports in 2003. **Japan** trails Ireland, Switzerland and the United States in high-technology exports, i.e. exports of pharmaceuticals, aircraft and spacecraft, office and computing machinery, radio, TV and communication equipment and precision instruments. **Japan** and the United States, have lost market share in high-technology industries in the OECD area over the past decade, mainly to the benefit of Mexico, Ireland, Belgium and Korea.

**Japan** accounted for over 14% of worldwide value added in manufacturing in 2002, making it the second largest manufacturing economy in the world, behind the United States that accounted for almost 26%. China accounted for about 8%, making it the third-largest manufacturing economy in the world, ahead of Germany.