I N D I N E W S

Newsletter on Science & Technology & Innovation Indicators

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This edition is devoted to the release of the third edition of the *European Report on Science & Technology Indicators 2003* which provides an objective and detailed overview of the EU-15, its Member States as well as competitors' investment and performance in scientific and technological research.

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DG Research releases its '***Third European Report on Science & Technology Indicators 2003***'

March the 17th, Commissioner Busquin presented the *Third European Report on Science & Technology Indicators 2003* to the press. This report presents the latest and most reliable data on investment and performance of European research, and compares the position of Europe and its Member States in these matters with their main competitors, Japan and the US. *"This report is not just a study – it is a policy tool"*, said Mr. Busquin. *"It will enable European leaders in research and innovation to monitor their progress. The aim is to map out and highlight the areas where Europe excels. This in turn will attract excellence. Increasingly, our researchers look first to the US before considering what is available for them here in Europe. To address our shortcomings and build on our strengths, we must first focus on the benefits that Europe has to offer."*

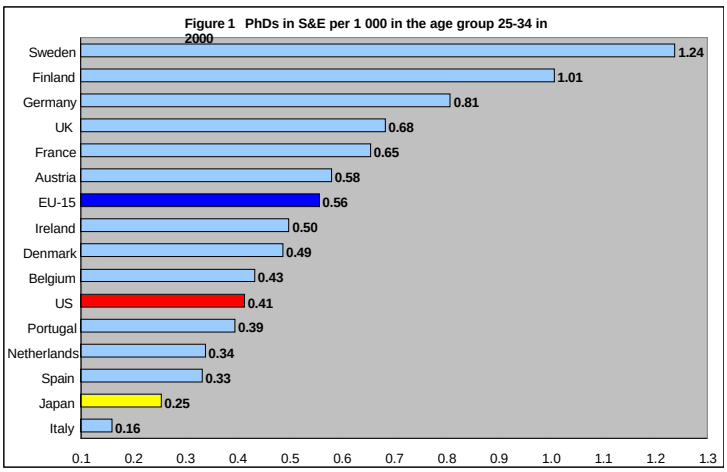
The report consists of two main parts:

- Part I deals with the investment in research, the level and characteristics of the public and private contributions herein, and with human resources in Science and Technology.
- Part II provides a detailed overview of Europe's scientific and technological performance compared with its main competitors, analysing European scores with regard to scientific publications, citations, Nobel prizes, patents and high-tech trade, and with special emphasis to the technological performance of European countries in bio- and nanotechnologies.

Some of the main findings are as following:

1. Human resources

The EU-15 produces a larger number of graduates and PhDs in science and technology than the US (2.14 million in 2000 for the EU-15, compared to 2.07 million in the US and 1.1 million in Japan). The differences are marked when analysing the number of PhDs (see Figure 1).

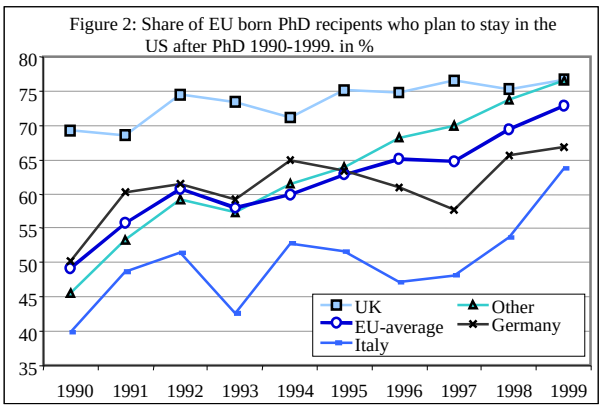


Source: DG-Research

The EU-15, however, employs fewer researchers (5.4 researchers per 1000 labour force, against 8.7 in the US and 9.7 in Japan).

When it comes to mobility of scientists in Europe, it is mainly internal: more than one-third of foreign students following tertiary education and 50% of foreign S&T employees come from another Member State. The majority of the S&T employees who decide to work abroad go to the US. In this respect, Europe encounters a substantial 'brain drain' and this trend has increased since the beginning of the 1990s. Nearly 75% of European PhD recipients prefer to stay in the US after their PhD. In 1990, this share was only 49% (see Figure 2). However, it has to be acknowledged that Europe is also gaining from in particular eastern European and Asian net inflows.

Figure 2: Share of EU born PhD recipents who plan to stay in the US after PhD 1990-1999. in %



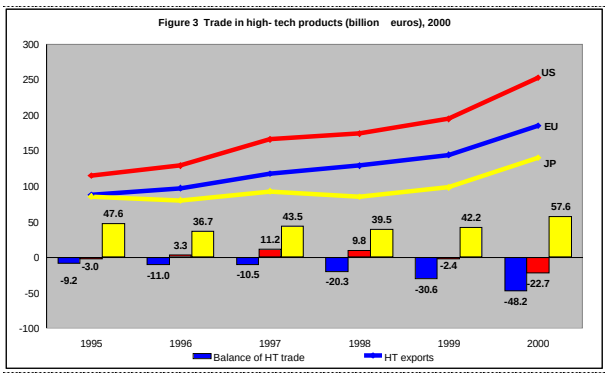
Source: DG-Research

2. Industry and competitiveness

European competitiveness deteriorating: growing high-tech trade deficit

Europe's performance in terms of high-tech trade is deteriorating: the trade deficit in high-tech products has grown from €9 billion in 1995 to €48 billion in 2000 (calculated in 1995 purchasing power standards).

Figure 3 Trade in high- tech products (billion euros), 2000



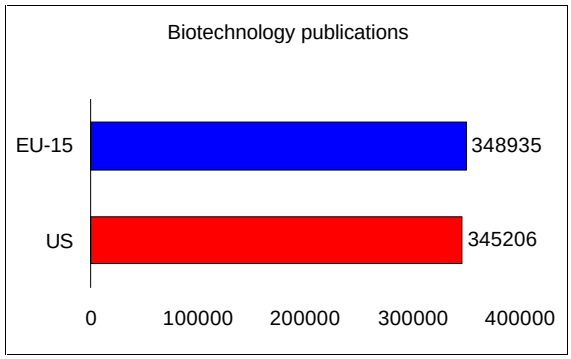
Source: DG-Research

High-tech exports increased from € 87.7 billion in 1995 to € 185.4 billion in 2000. Yet, high-tech imports rose from € 96.9 billion to € 233.6 billion (€ 1995 PPS).

How about performance in key technologies?

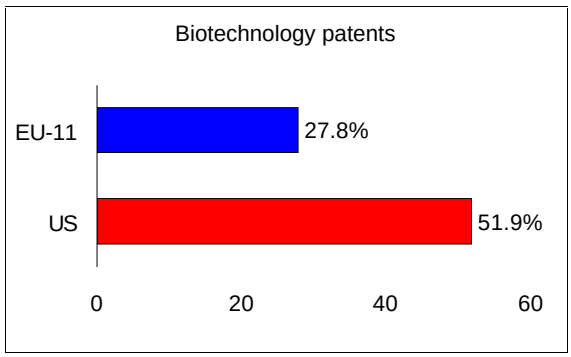
Europe is lagging behind in the biotechnology commercialisation. It has a larger scientific production than the US in the field (see figure 4), but European firms are weaker when it comes to patenting and commercialisation (see Figure 5). At the European patent office (EPO), where European companies can be expected to have a home-advantage, they account for 27.8 % of patent applications, whereas US firms account for a much larger share of 51.9 %.

Figure 4: Biotechnology related publications (1994-1999)



Source: DG-Research

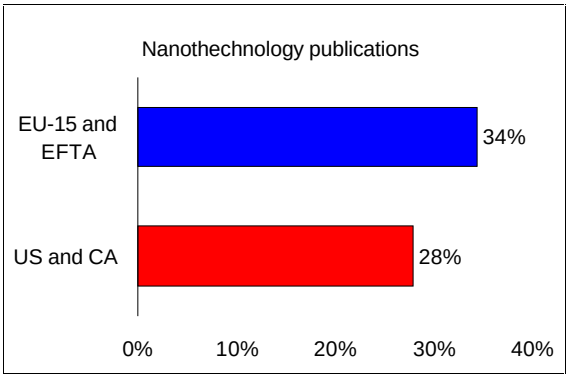
Figure 5: Biotechnology patent shares (EPO), 1999



Source: DG-Research

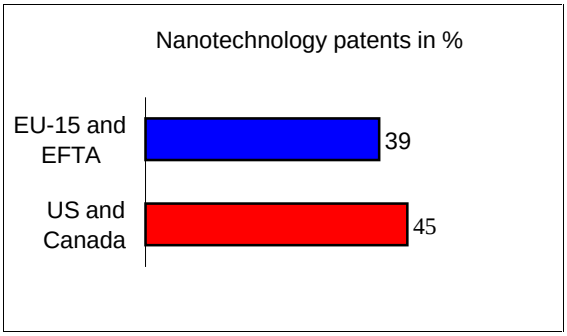
In the field of nanotechnology - another emerging key technology - Europe is performing well in terms of scientific production and even in terms of patenting (see Figures 6 and 7). The EU-15 and EFTA together account for 39 % of European and world nanotechnology-related patents, compared to 45% for the US and Canada.

Figure 6: Nanotechnology publication shares, 1997-1999



Source: DG-Research

Figure 7: Nanotechnology patent shares (EPO and PCT), 1991-1999



Source: DG-Research

The relatively better performance of Europe in nanotechnology might be explained by specialisation patterns. The US is much more specialised scientifically as well as technologically in most life sciences fields and has a highly performing innovation infrastructure (science-firm relationships, knowledge transfer from academia to business) in these fields. Europe, on the other hand, is relatively more specialised in the engineering fields. Despite the fact of the early stages of both bio- and nanotechnology, the latter offers even in its early stage a number of divers successful applications, possibly relatively cheaper then in biotechnology, leading to a relatively higher number of patent applications by European companies or universities.

In terms of overall technological performance, over the last decade Europe's share of patent applications at the EPO and patents granted at the United States Patent and Trademark Office (USPTO) has declined, although it appears to have stabilised in the last few years.

3. Scientific output

Europe tops the US and Japan in terms of scientific publications. The evidence shows that European institutions are good at creating knowledge, which is their core objective. They are increasingly collaborating with enterprises, which is a positive development.

Table 1: Best performing universities per Member State

Top performers in terms of publications		Top performers in terms of citations		Top performers in terms of impact	
Univ. London	85182	Univ. London	550278	Univ. Cambridge	1.55
Univ. Paris 6	22154	Karolinska Inst.	116900	Eindhoven Univ. Techno.	1.40
Univ. Milan	16972	Univ. Paris 6	100372	Tech. Univ. Munich	1.40
Univ. Lund	16341	Leiden Univ.	86682	Univ. Strasbourg 1	1.32
Univ. Munich	16208	Univ. Munich	83477	Univ. Cath. Louvain	1.30
Kath. Univ. Leuven	15420	Univ. Milan	81963	Univ. Helsinki	1.29
Univ. Utrecht	14942	Univ. Helsinki	81531	Tech. Univ. Denmark	1.24
Univ. Helsinki	13446	Kath. Univ. Leuven	68876	Karolinska Inst.	1.22
Univ. Vienna	12485	Univ. Copenhagen	63432	Univ. Dublin	1.16
Univ. Copenhagen	11667	Univ. Vienna	50255	Univ. Padua	1.04
Univ. Barcelona	9678	Univ. Barcelona	33705	Univ. Florence	1.04
Univ. Athens	6609	Natl. Univ. Ireland	14842	Univ. Innsbruck	1.03
Natl. Univ. Ireland	5054	Univ. Athens	13279	Autonomous Univ. Madrid	0.99
Tech. Univ. Lisbon	2638	Univ. Lisbon	6338	Univ. Lisbon	0.88
				Natl. Tech. Univ. Athens	0.88

On the basis of available evidence analysed in detail in the report, one can identify two different emerging strategies in Europe's universities population. Some large universities try and establish a solid presence in all fields of science, resulting in a large number of scientific publications with good citation impact scores (see first and second columns in table 1). Other universities are much more focused and specialised, and only active in a limited number of fields, resulting in a somewhat smaller overall number of publications but with often higher than world average citation impact scores (see third column).

4. European perspectives

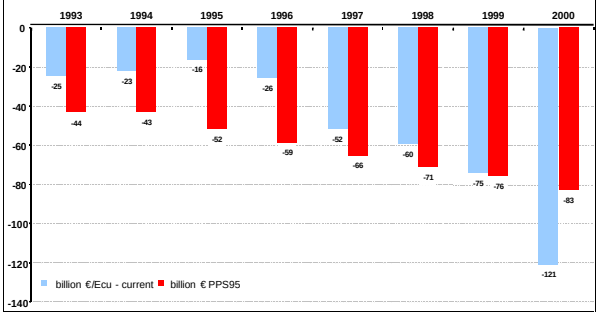
The EU-15 as a whole is still spending much less on R&D (in 2000, 1.94% of its GDP) than its main competitors the US (2.80%) and Japan (2.98%). Moreover, this "investment gap" is widening at a fast pace since the mid-1990s since it has nearly doubled between 1994 and 2000. In constant terms it increased from € 43 billion in 1994 to € 83 billion in 2000.

Europe's investing less and is not catching up

Moreover, Europe is not catching up with Japan and the US in terms of R&D investment. The proportion of GDP devoted to R&D grew during the second half of the 1990s at a much slower rate in the EU (+0.6% per year) than in the US (+1.7% per year) or in Japan (+1.8% per year) (see Figure 8).

The investment gap is mainly due to the low contribution of the private sector, which represents in Europe only 56 % of the total financing of research - against more than two-thirds in the US and Japan. It is also due to the weak growth in R&D spending by the larger Member States such as France, the UK and Italy, partially compensated, however, by the good performance of some Member States such as Finland, Greece, and Portugal.

Figure 8: GDP on R&D (GERD) - EU-15 and US in billion € and billion PPS at 1995 prices



Source: DG-Research

As far as defence and dual-use R&D are concerned, the fragmentation and artificial separation between civilian and military research severely hinders Europe's competitiveness. Uncoordinated and scattered research efforts hamper overall EU R&D efficiency, but this is particularly true in the defence sector, where Europeans are unable to consistently translate research into technological applications. On the contrary, the US have been particularly successful in this respect: the GPS (Global Positioning System), the world wide web (internet) and satellite telecommunications represent success stories, with the first concept being developed for defence purposes and eventually adapted into civilian products and services.

3% in 2010: Myth or reality?

An awareness of the gap in R&D investment is crucial, because it risks translating into a widening gap in the accumulation of economically useful knowledge, which has obvious implications for the European competitiveness. However, if the current trend continues, the best the EU-15 can hope for, is a R&D investment rate of around 2.2% - 2.3% by 2010. It is clear, then, that if the EU still maintains its aim to increase its overall level of research expenditure to a figure approaching 3% of GDP by 2010, substantial efforts are needed to create the conditions in which this might be achieved.

In this context, it needs to be emphasised that levels of financing R&D in different sectors (government, business) are not independent of one another. Government is responsible for financing the science base from which many of the technological opportunities that stimulate industrial R&D spending will emerge. If implemented in the right way, government research funding activities can provide new incentive structures for businesses to participate both as financiers and as performers of high-quality research.

The report is available through request. More snapshots and further information is available at K3's website @ http://www.cordis.lu/rtd2002/indicators/third_report.htm

Miscellaneous

Conferences

Reinventing Regions in a Global Economy

The Regional Studies Association will organise this International Conference on 12th-15th April 2003, in the Pisa Conference Centre**,** Italy. The main conference topics proposed are: knowledge economy; regional restructuring; rural development and the new rural economy; new forms of regional governance; demographic change education and skills; regional competitiveness; new development in regional theory and evaluation and regional policy. For more information, see: www.regional-studies-assoc.ac.uk

Innovation in Europe: Dynamics, Institutions and Values

An International Conference will be organised by the Roskilde University in Denmark, on 8th-9th May 2003. Some of the main conference topics are: systems of innovation, institutions and values in Europe; knowledge dynamics and co-operation; intellectual property rights, innovation for competitiveness and cohesion. Further information is available on: www.segera.ruc.dk/

Evaluation of government funded R&D activities

A two days conference including parallel sessions and workshops will be co-organised by Joanneum Research and ZEW and held in Vienna, May 15-16. The main subject will be the impact of R&D policy instruments on innovation, structural change and technology leadership – topics very much related to the 3 % goal. For more information see www.fteval.at/conference/