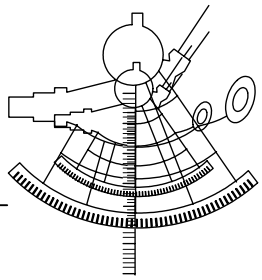
European Trend Chart on Innovation



2002 European Innovation Scoreboard: Technical Paper No 4 Indicators and Definitions

November 25, 2002

European Commission
Enterprise Directorate-General

A publication from the Innovation/SMEs Programme

The European Trend Chart on Innovation

Innovation is a priority of all Member States and of the European Commission. Throughout Europe, hundreds of policy measures and support schemes aimed at innovation have been implemented or are under preparation. The diversity of these measures and schemes reflects the diversity of the framework conditions, cultural preferences and political priorities in the Member States. The 'First Action Plan for Innovation in Europe', launched by the European Commission in 1996, provided for the first time a common analytical and political framework for innovation policy in Europe.

Building upon the Action Plan, the *Trend Chart on Innovation in Europe* is a practical tool for innovation policy makers and scheme managers in Europe. Run by the European Commission (Innovation Directorate of DG Enterprise), it pursues the collection, regular updating and analysis of information on innovation policies at national and Community level, with a focus on innovation finance; setting up and developing innovative businesses; the protection of intellectual property rights; and the transfer of technology between research and industry.

The Trend Chart serves the "open policy co-ordination approach" laid down by the Lisbon Council in March 2000. It delivers summarised and concise information and statistics on innovation policies, performances and trends in the European Union. It is also a European forum for benchmarking and the exchange of good practices in the area of innovation policy.

The Trend Chart products

The Trend Chart on Innovation has been running since January 2000. It tracks innovation policy developments in all EU Member States, plus Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Iceland, Israel, Latvia, Liechtenstein, Lithuania, Norway, Poland, Romania, Slovak Republic and Slovenia. The Trend Chart website (www.cordis.lu/trendchart) provides access to the following services and publications:

- the European Innovation Scoreboard and other statistical reports;
- regular country reports for all countries covered;
- a database of policy measures across Europe;
- a "who is who?" of agencies and government departments involved in innovation;
- regular trend reports covering each of the four main themes;
- benchmarking reports from the Trend Chart workshops;
- a news service and thematic papers;
- the annual reports of the Trend Chart.

The present report was prepared by Hugo Hollanders of MERIT (www.merit.unimaas.nl). The information contained in this report has not been validated in detail by either the Member States or the European Commission.

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European Innovation Scoreboard

The European Innovation Scoreboard (EIS) was developed at the request of the Lisbon European Council in 2000[1]. It focuses on high-tech innovation and provides indicators for tracking the EU's progress towards the Lisbon goal of becoming the most competitive and dynamic knowledge-based economy in the world within the next decade.

The EIS contains 17 main indicators, selected to summarize the main drivers and outputs of innovations. These indicators are divided into four groups: Human resources for innovation (5 indicators); the creation of new knowledge (3 indicators of which one is divided into EPO and USPTO patents); the transmission and application of knowledge (3 indicators); and Innovation finance, outputs and markets (6 indicators).

The EIS complements the *Enterprise Policy Scoreboard*[2] and other benchmarking exercises of the European Commission. It mainly uses Eurostat data, or private data of sufficient reliability if official data is not available. Six indicators are drawn from the European Commission's Structural indicators.

All indicators have been updated based on data availability as of September 15, 2002. Four indicators could not be updated due to delays in the execution of the third Community Innovation Survey[3]. As a result, the 2002 EIS does not provide trend results for these indicators and it does not contain a summary innovation index similar to the one offered in 2001. Subject to the availability of new CIS data, the 2003 EIS is expected to offer again an updated composite innovation index and a comparison between the index and average trends for each country, which was one of the most interesting features of the 2001 EIS.

The EIS is complemented by six technical papers:

(1) Technical Paper No 1: Member States and Associate Countries
Detailed results for current and trend data, innovation leaders, relative strengths and weaknesses per country, convergence and divergence analysis between member states and different groups of member states, and country pages with trend diagrams and main policy changes.

(2) Technical Paper No 2: Candidate Countries
Detailed results for current and trend data, innovation leaders, relative strengths and weaknesses per country, and country pages with both current and trend graphs.

(3) Technical Paper No 3: EU Regions
Detailed results for currently available data, leading regions, two tentative composite innovation indicators, indicator graphs, and preliminary steps towards the 2003 regional scoreboard.

(4) Technical Paper No 4: Indicators and Definitions
Full definitions and graphs for all indicators.

(5) Technical Paper No 5: Thematic Scoreboard "Lifelong Learning for Innovation"
Prototype of a complementary scoreboard on "Lifelong Learning for Innovation".

(6) Technical Paper No 6: Methodological Report
Overview of five different methods for constructing composite indices, and review of the similarities and differences between the EIS and other European Commission scoreboards.

All technical papers are available from the Trend Chart website (www.cordis.lu/trendchart).

[1] A first provisional EIS was published in September 2000: COM(2000) 567. The first full version of the EIS was published in October 2001: SEC(2001) 1414.
[2] SEC(2002) 1213.
[3] These are indicators 3.1, 3.2, 3.3 and 4.3.

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Introduction

This Technical Paper No 4: Indicators and Definitions complements the 2002 EIS. It presents the full definitions of all indicators, years used, a brief interpretation justifying why the indicator has been selected, and indicator graphs showing the EIS 2002 figures for all countries.

The data sources are also indicated with each graph (mostly EUROSTAT). For Accession and Candidate countries most data comes from a survey conducted especially for the 2002 EIS in co-operation with the "Group of Senior Officials in Innovation Policy". This national data is used wherever EUROSTAT data is not yet available.

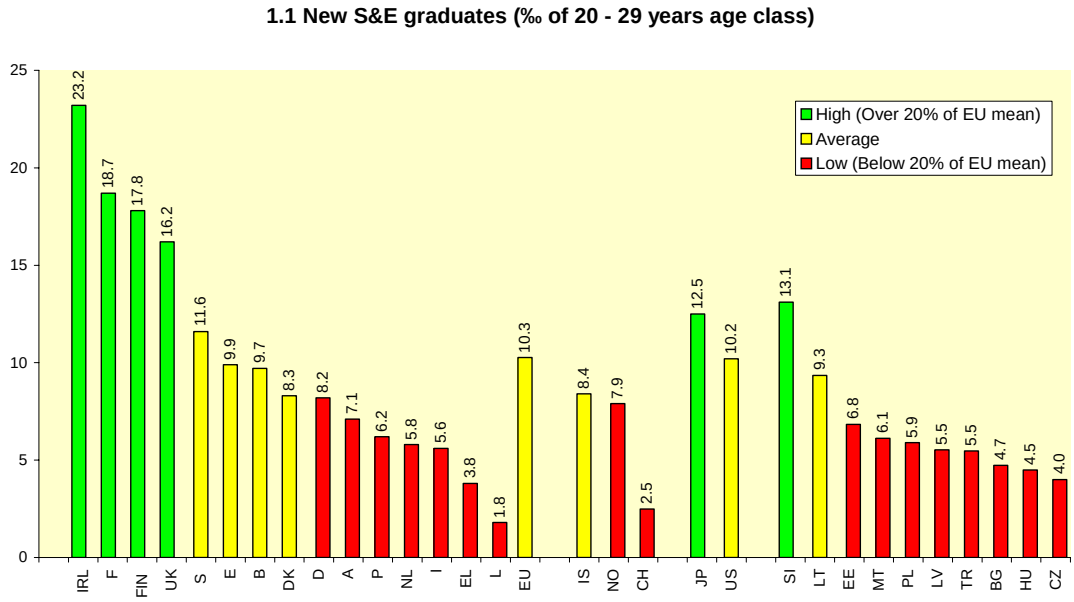
The EIS indicators are divided into four categories, containing 17 main indicators and 3 additional indicators for the Candidate countries, all selected to summarize the main drivers and outputs of innovations:

- Human resources for innovation, comprising 5 main indicators:
  - 1.1 New S&E graduates (‰ of 20-29 years age class)
  - 1.2 Population with tertiary education (% of 25-64 years age classes)
  - 1.3 Participation in life-long learning (% of 25-64 years olds)
  - 1.4 Employment in medium-high and high-tech manufacturing (% of total workforce)
  - 1.5 Employment in high-tech services (% of total workforce)
- The creation of new knowledge, comprising 3 main indicators of which one is divided into EPO and USPTO patents:
  - 2.1 Public R&D expenditures (GERD - BERD) (% GDP)
  - 2.2 Business expenditure on R&D (BERD) (% GDP)
  - 2.3.1 EPO high-tech patent applications (per million population)
  - 2.3.2 USPTO high-tech patent applications per million population
  - And one alternative indicator for the Candidate countries:
  - 2.3.1A All EPO patent applications (per million population) (replacing EPO high-tech patent applications),
- The transmission and application of knowledge, comprising 3 main indicators:
  - 3.1 SMEs innovating in-house (% of manufacturing SMEs)
  - 3.2 Manufacturing SMEs involved in innovation co-operation
  - 3.3 Innovation expenditures (% of all turnover in manufacturing)
- Innovation finance, outputs and markets, comprising 6 main indicators:
  - 4.1 High-tech venture capital investment (‰ of GDP)
  - 4.2 New capital raised on stock markets (% of GDP)
  - 4.3 'New to market' products (% of sales by manufacturing firms)
  - 4.4 Home internet access ((% of all households)
  - 4.5 ICT expenditures (% of GDP)
  - 4.6 Percent of manufacturing value-added from high technology
  - And two alternative indicators for the Candidate countries:
  - 4.4A Internet access (% of population) (replacing home internet access per household)
  - 4.6A Stock of inward FDI (% of GDP) (replacing percent of manufacturing value-added from high technology)

For each indicator the following pages will provide the full definition, a brief interpretation and indicator graphs showing the EIS 2002 performance of all countries.

1 Human Resources

1.1 New S&E graduates (‰ of 20-29 years age class)



Sources: EUROSTAT, Education statistics; GSO survey for CH, BG, EE, HU, LT, LV, MT and TR; years used: 2000 for all countries, except 1999 for CZ, DK, F, FIN, HU, I, PL and SI, 1996 for JP, 1995 for TR, and 1993 for EL.

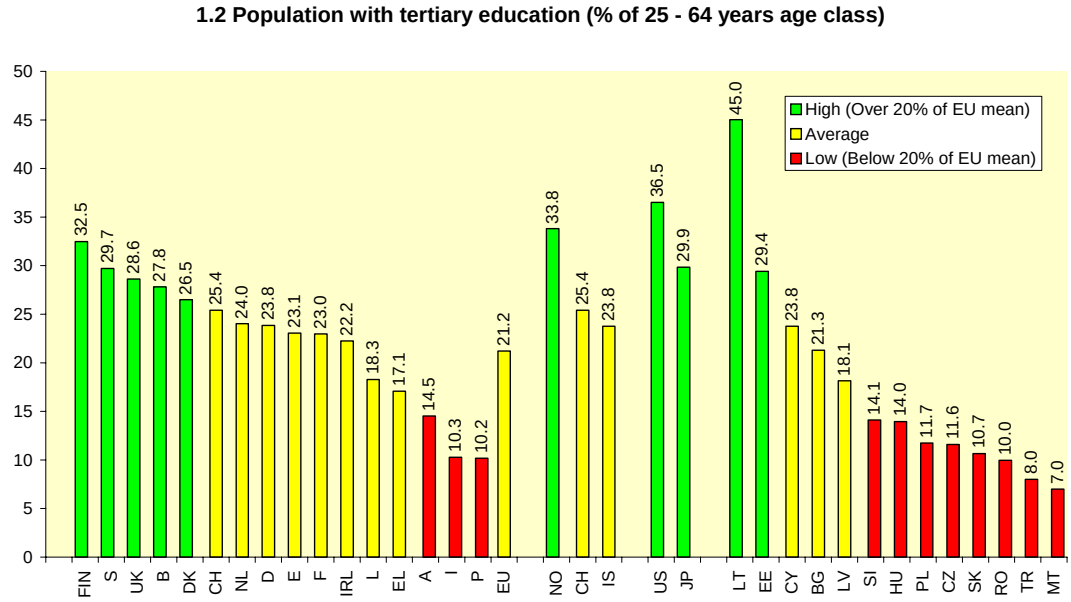
Definition

The reference population is all age classes between 20 and 29 years inclusive. Tertiary graduates in Science & Engineering (S&E) are defined as all post-secondary education graduates (ISCED classes 5a and above) in life sciences (ISC42), physical sciences (ISC44), mathematics and statistics (ISC46), computing (ISC48), engineering and engineering trades (ISC52), manufacturing and processing (ISC54) and architecture and building (ISC58). Due to a change in definition a comparison with the 2001 Scoreboard results is not possible. This indicator is identical to Structural indicator 2.4: Science and technology graduates.

Interpretation

The indicator is a measure of the supply of new graduates with training in Science & Engineering (S&E). Due to problems of comparability for educational qualifications across countries, this indicator uses broad educational categories. This means that it covers everything from graduates of one-year diploma programmes to PhDs. A broad coverage can also be an advantage, since graduates of one-year programmes are of value to incremental innovation in manufacturing production and in the service sector.

1.2 Population with tertiary education (% of 25-64 years age classes)



Sources: EUROSTAT, Labour Force Survey; GSO survey for CH and MT; years used: 2001 for all countries, except 2000 for D, JP, L, S and US, 1999 for TR, and 1997 for IRL.

Definition

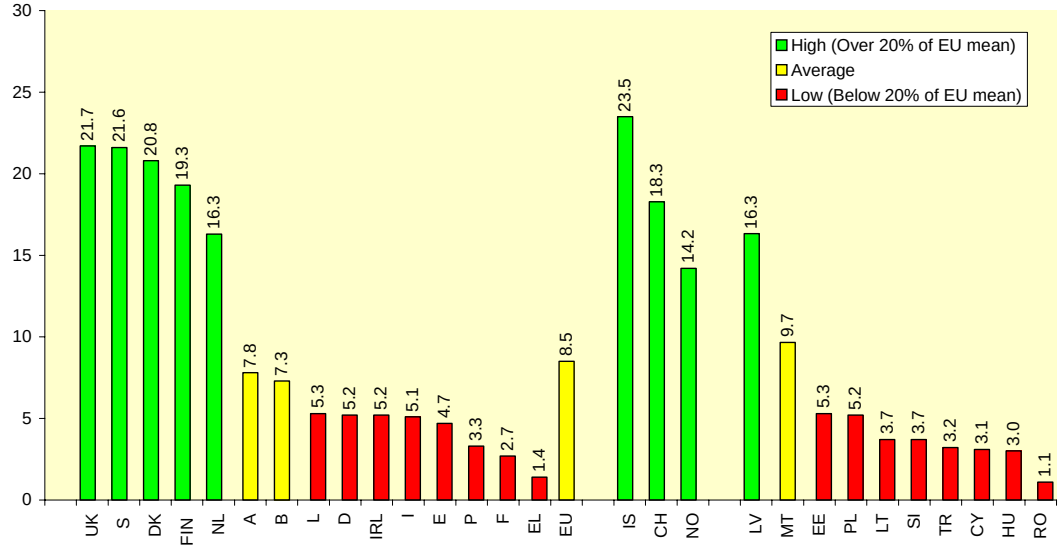
The percentage of the total working age population (25-64 years age classes) with some form of post-secondary education (ISCED 5 and 6).

Interpretation

This is a general indicator of the supply of advanced skills. It is not limited to science and technical fields because the adoption of innovations in many areas, particularly in the service sectors, depends on a wide range of skills. Furthermore, it includes the entire working age population, because future economic growth could require drawing on the non-active fraction of the population. International comparisons of educational levels however are notoriously difficult due to large discrepancies in educational systems, access, and the level of attainment that is required to receive a tertiary degree. Therefore, differences among countries should be interpreted cautiously.

1.3 Participation in life-long learning (% of 25-64 years olds)

1.3 Participation in life-long learning (% of 25 - 64 years age class)



Sources: EUROSTAT, Labour Force Survey; GSO survey for CH, LV, MT and TR; years used: 2001 for all countries, except 2000 for CY, 1999 for CH, 1997 for A and IRL, and 1996 for TR.

Definition

The reference population is all age classes between 25 and 64 years inclusive. A reference period of four weeks has been chosen in order to avoid distortion of information due to recall problems. The reference period is the last four weeks preceding the survey, except for France, the Netherlands (until 1999) and Portugal for which information is collected only if education or training is under way on the date of the survey. Education includes initial education, further education, continuing or further training, training within the company, apprenticeship, on-the-job training, seminars, distance learning, evening classes, self-learning, etc. as well as other courses followed for general interest: language, data-processing, management, art/culture, health/medicine courses. Before 1998, education was related only to education and vocational training which was relevant for the current or possible future job of the respondent. This indicator is identical to Structural indicator 1.7.

Interpretation

A central characteristic of a knowledge economy is continual technical development and innovation. Under these conditions, individuals need to continually learn new ideas and skills - or to participate in life-long learning. All types of learning are valuable, since it prepares people for “learning to learn”. The ability to learn can then be applied to new tasks with social or economic benefits. The limitation of the indicator to a brief window of four weeks could reduce comparability between countries due to differences in adult education systems. Little is known at this time about such differences, but differences in the timing of national holidays, preferred times for adult education courses, the average length of adult courses, and other unknown factors could influence the results and reduce comparability. Technical Paper N° 5 of the 2002 EIS further elaborates on the issue of “Lifelong Learning for Innovation”.

1.4 Employment in medium-high and high-tech manufacturing (% of total workforce)

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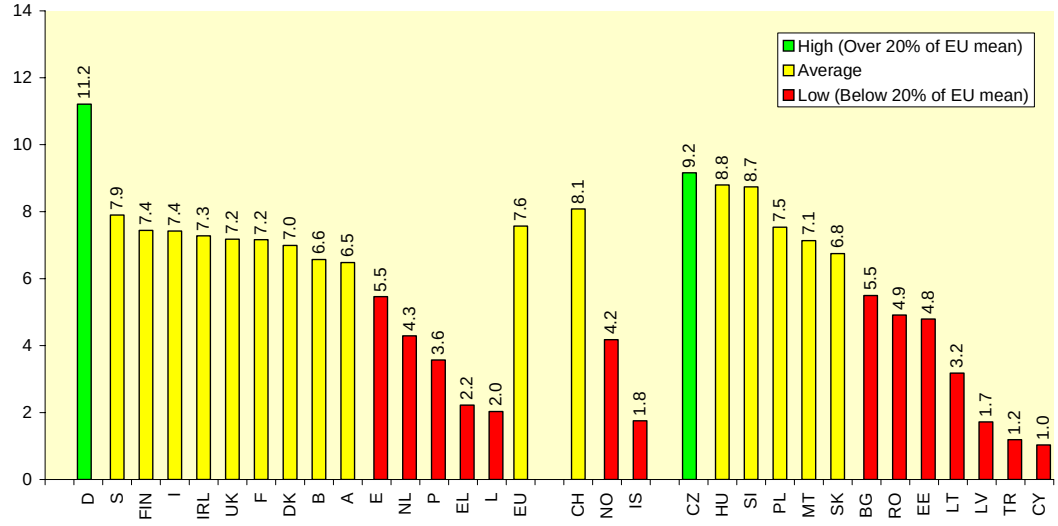


Sources: EUROSTAT, Labour Force Survey; GSO survey for MT, PL and TR; years used: 2001 for all countries, except 2000 for S and TR, and 1999 for PL.

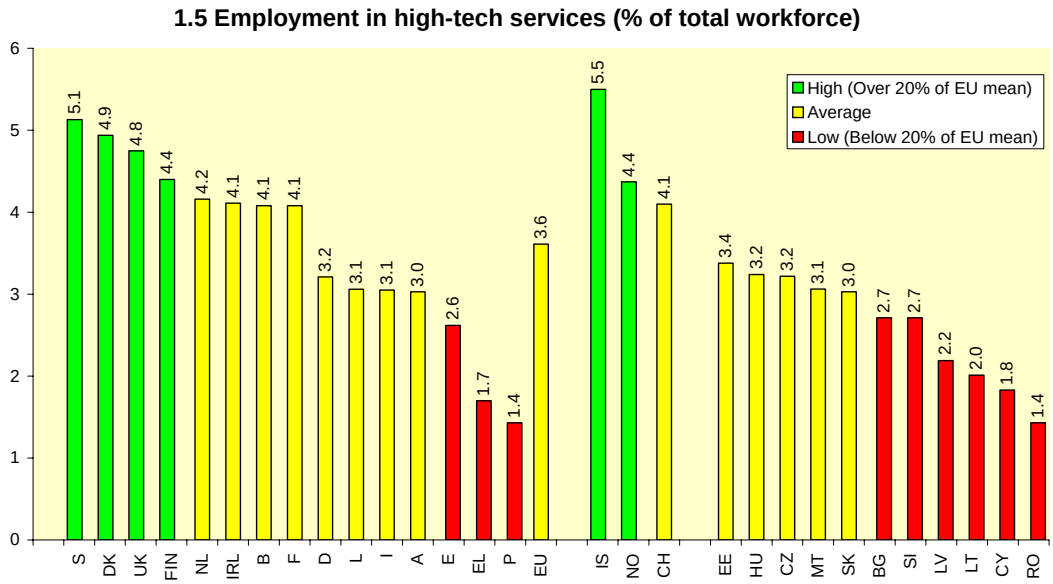
Definition

The medium-high and high technology sectors include chemicals NACE (24), machinery (NACE 29) office equipment (NACE 30), electrical equipment (NACE 31), telecom equipment (NACE 32), precision instruments (NACE 33), automobiles (NACE 34), and aerospace and other transport (NACE 35). The total workforce includes all manufacturing and service sectors.

Interpretation

The percentage of employment in medium-high and high technology manufacturing sectors is an indicator of the share of the manufacturing economy that is based on continual innovation through creative, inventive activity. The use of total employment gives a better indicator than using the share of manufacturing employment alone, since the latter will be affected by the hollowing out of manufacturing in some countries.

1.5 Employment in high-tech services (% of total workforce)



Sources: EUROSTAT, Labour Force Survey; GSO survey for MT; years used: 2001 for all countries, except 2000 for S.

Definition

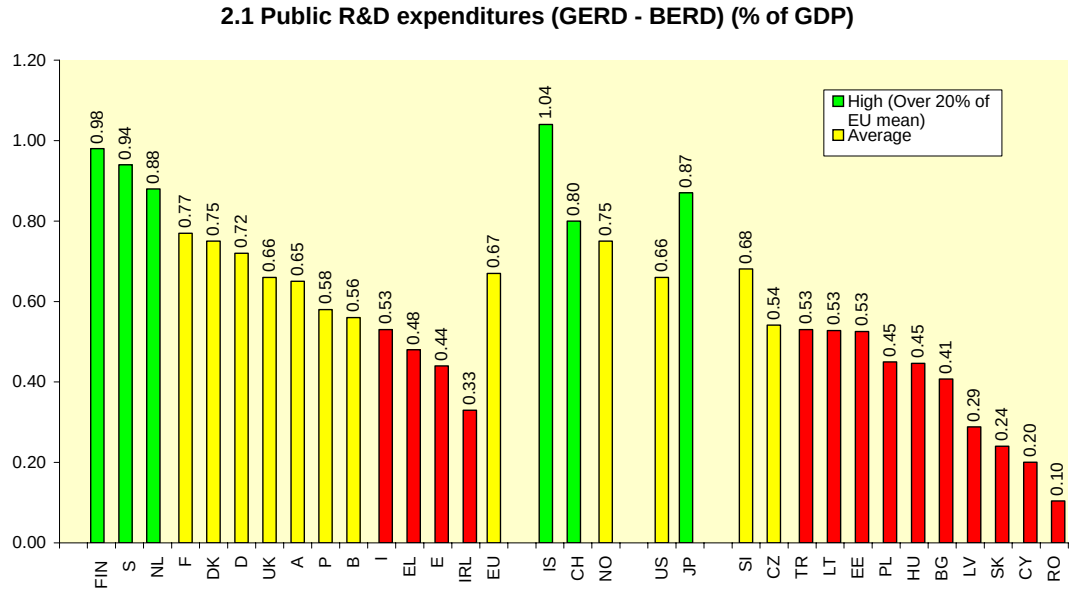
This indicator focuses on three leading edge sectors that produce high technology services: post and telecommunications (NACE 64); information technology including software development (NACE 72); and R&D services (NACE 73). The total workforce includes all manufacturing and service sectors.

Interpretation

The high technology services both provide services directly to consumers, such as telecommunications, and provide inputs to the innovative activities of other firms in all sectors of the economy. The latter can increase productivity throughout the economy and support the diffusion of a range of innovations, particularly those based on ICT.

2 Knowledge creation

2.1 Public R&D expenditures (GERD - BERD) (% GDP)



Sources: EUROSTAT, R&D statistics; GSO survey for CH, IS, BG, CZ, EE, HU, LT, LV and TR; years used: 2001 for D, E, FIN, IS, UK, 2000 for BG, CH, CZ, DK, EE, F, HU, JP, LT, LV, PL, SK, TR and US, 1999 for B, CY, EL, I, IRL, NL, NO, P, RO, S and SI, and 1998 for A.

Definition

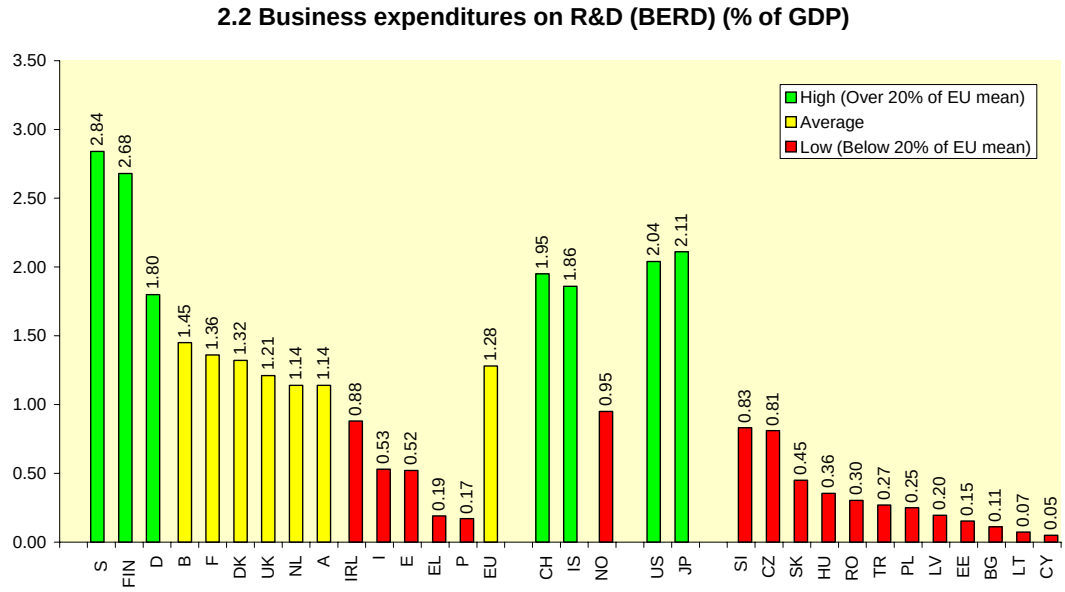
The indicator is the percentage of GDP due to public R&D spending. The latter is defined as the difference between total R&D expenditures (GERD) and business enterprise expenditures (BERD). It thus includes higher education expenditure in R&D (HERD), government expenditure in R&D (GORD) and private non-profit expenditure in R&D (PNRD). Note that this definition has changed compared to the 2001 EIS as it now also includes private non-profit expenditure in R&D (PNRD). This indicator was identical to the initial Structural indicator 2.2: R&D expenditure. The definition of Structural indicator 2.2 was changed in October 2002[4]: the R&D indicators are now disaggregated by source of finance rather than the sector carrying out the R&D expenditure. This change in definition could, due to time constraints, not be taken into account in the 2002 EIS.

Interpretation

In addition to the production of basic and applied knowledge in universities and higher-education institutions, publicly funded research offers several other outputs of direct importance to private innovation: trained research staff and new instrumentation and prototypes.

[4] COM(2002): 551.

2.2 Business expenditure on R&D (BERD) (% GDP)



Sources: EUROSTAT, R&D statistics; GSO survey for CH, IS, BG, CZ, EE, HU, LT, LV and TR; years used: 2001 for D, E, FIN, IS, UK, 2000 for B, BG, CH, CZ, DK, EE, F, HU, JP, LT, LV, PL, SK, TR and US, 1999 for CY, EL, IRL, NL, NO, P, RO, S and SI, and 1998 for A.

Definition

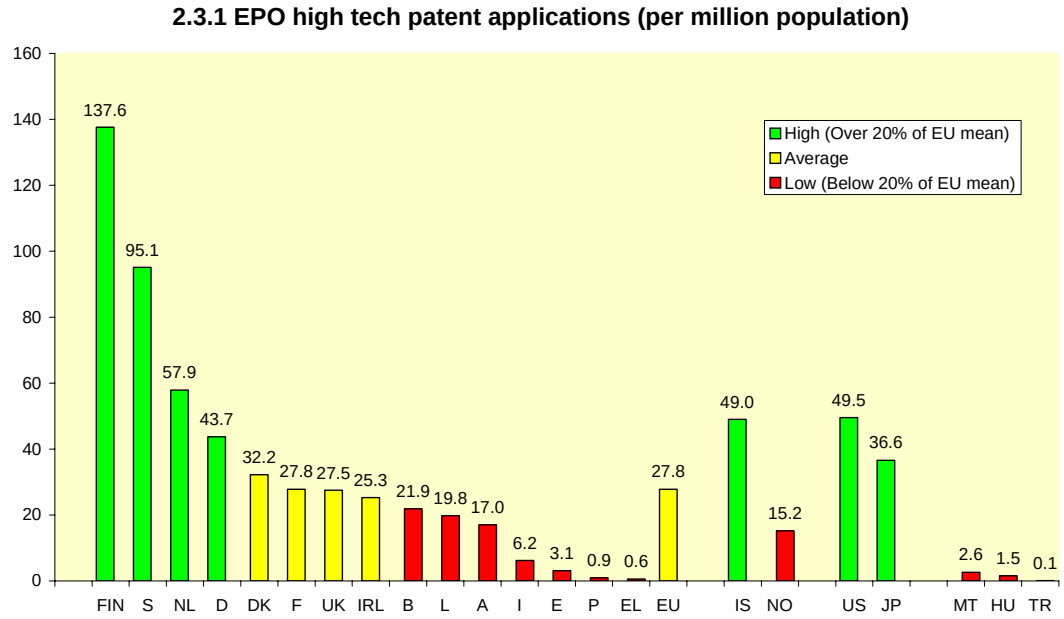
This indicator measures the R&D expenditure (from all sources of funding) of the business sector (manufacturing and services) as a percentage of GDP. This indicator was identical to the initial Structural indicator 2.2: R&D expenditure. The definition of Structural indicator 2.2 was changed in October 2002[5]: the R&D indicators are now disaggregated by source of finance rather than the sector carrying out the R&D expenditure. This change in definition could not, due to time constraints, be taken into account in the 2002 EIS.

Interpretation

The indicator captures the formal creation of new knowledge within firms. It is particularly important in the science-based sectors (pharmaceuticals, chemicals and some areas of electronics) where most new knowledge is created in or near R&D laboratories.

[5] COM(2002): 551.

2.3.1 EPO high-tech patent applications (per million population)



Sources: EUROSTAT; GSO survey for HU, MT and TR; years used: 2000 for all countries, except 1999 for MT, and 1998 for TR.

Definition

The indicator is defined as the number of patent applications (reference year is year of filing) at the EPO in high-technology patent classes per million population. The national (and regional) distribution of the patent applications is assigned according to the address of the inventor. The high technology patent classes include pharmaceuticals, biotechnology, information technology, and aerospace. The following IPC subclasses are included:

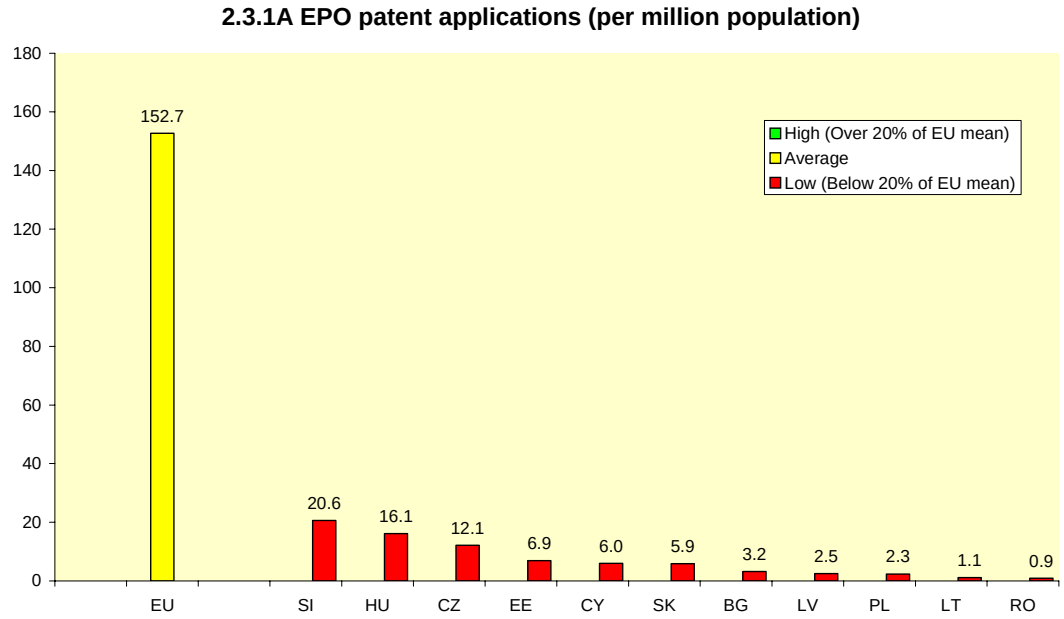
- B41J: typewriters; selective printing mechanisms, i.e. mechanisms printing otherwise than from a form; correction of typographical errors
- G06C: digital computers in which all the computation is effected mechanically
- G06D: digital fluid-pressure computing devices
- G06E: optical computing devices
- G06F: electric digital data processing
- G06G: analogue computers
- G06J: hybrid computing arrangements
- G06K: recognition of data; presentation of data; record carriers; handling record carriers
- G06M: counting mechanisms; counting of objects not otherwise provided for
- G06N: computer systems based on specific computational models
- G06T: image data processing or generation, in general
- G11C: static stores
- B64B: lighter-than-air aircraft
- B64C: aeroplanes; helicopters
- B64D: equipment for fitting in or to aircraft; flying suits; parachutes; arrangements or mounting of power plants or propulsion transmissions
- B64F: ground or aircraft-carrier-deck installations
- B64G: cosmonautics; vehicles or equipment therefore

- C12M: apparatus for enzymology or microbiology
- C12N: micro-organisms or enzymes; compositions thereof; propagating, preserving, or maintaining micro-organisms; mutation or genetic engineering; culture media
- C12P: fermentation or enzyme-using processes to synthesize a desired chemical compound or composition or to separate optical isomers from a racemic mixture
- C12Q: measuring or testing processes involving enzymes or micro-organisms
- H01S: devices using stimulated emission
- H01L: semiconductor devices; electric solid state devices not otherwise provided for
- H04B: transmission
- H04H: broadcast communication
- H04J: multiplex communication
- H04K: secret communication; jamming of communication
- H04L: transmission of digital information, e.g. telegraphic communication
- H04M: telephonic communication
- H04N: pictorial communication, e.g. television
- H04Q: selecting
- H04R: loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers; deaf-aid sets; public address systems
- H04S: stereophonic systems

Interpretation

This indicator complements indicator 2.2 on business R&D in that patenting captures new knowledge created anywhere within a firm and not just within a formal R&D laboratory. The indicator also measures specialisation of knowledge creation in fast-growing technologies.

2.3.1A EPO patent applications (per million population)



Source: EUROSTAT; years used: 2000 for all countries.

Definition

The indicator is defined as the number of all patent applications at the EPO per million population. The national (and regional) distribution of the patent applications is assigned according to the address of the inventor.

Interpretation

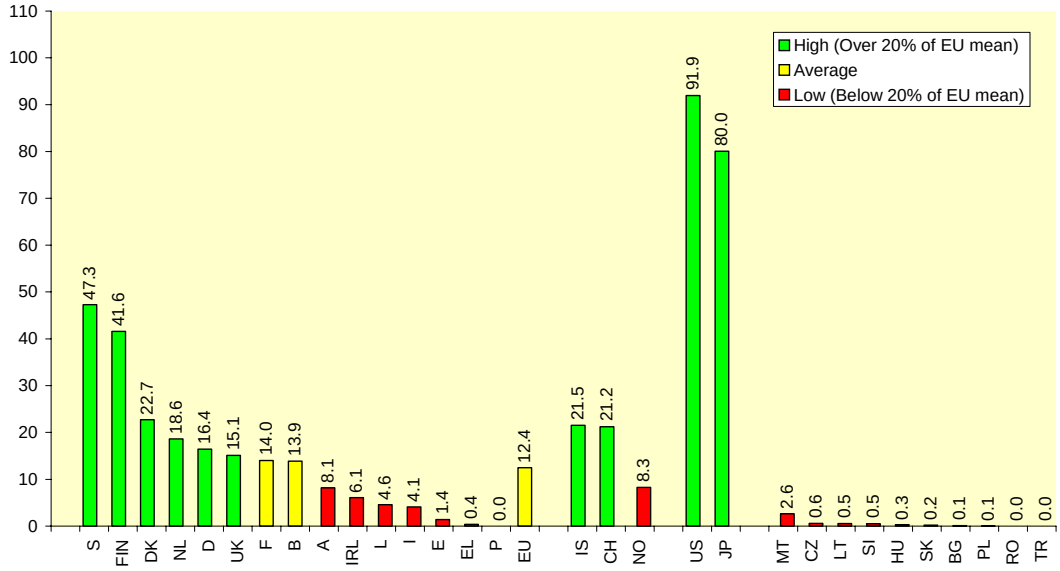
This indicator complements indicator 2.2 on business R&D in that patenting captures new knowledge created anywhere within a firm and not just within a formal R&D laboratory.

Candidate countries

This indicator is used as an alternative for indicator 2.3.1 as the numbers for high-technology EPO patent applications are too small.

2.3.2 USPTO high-tech patent applications per million population

2.3.2 USPTO high tech patent applications (per million population)



Sources: USPTO; GSO survey for CH and MT; years used: 2000 for all countries, except 2001 for MT, 1999 for SK, 1998 for LT, 1997 for BG and TR, and 1995 for RO.

Definition

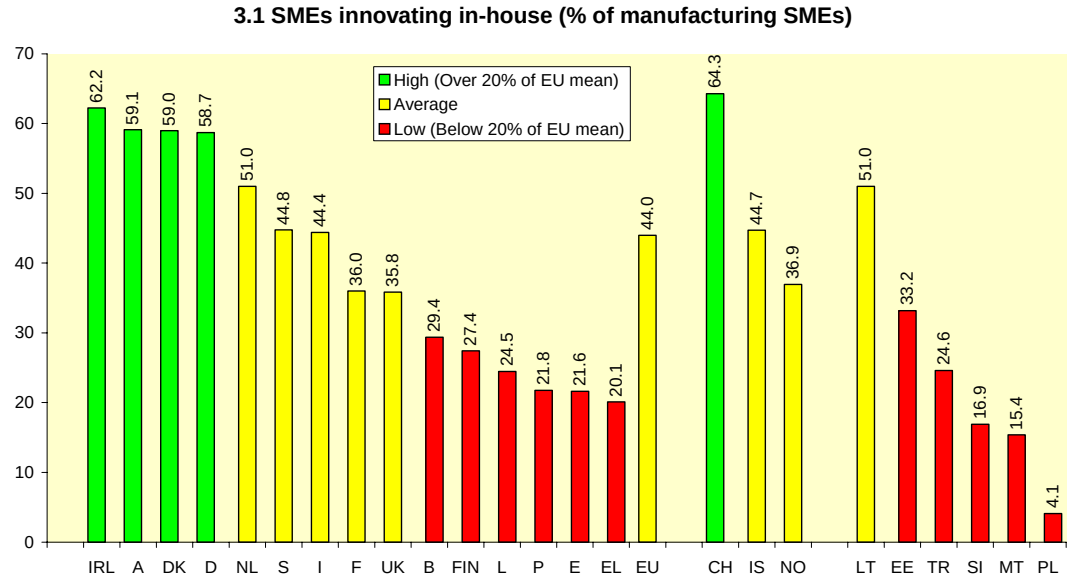
The indicator is defined as the number of patent applications at the US Patent and Trade Mark Office (USPTO) in high-technology patent classes, per million population. The high technology patent classes are the same as those for indicator 2.3.1.

Interpretation

Indicator 2.3.1 on EPO patent applications favours European versus American and Japanese firms. The present indicator provides the equivalent for American firms and measures US patenting activity by European inventors.

3 Transmission and application of knowledge

3.1 SMEs innovating in-house (% of manufacturing SMEs)



Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, IS, NO, EE, LT, MT and TR; years used: 1996 for all countries, except 2000 for EE, 1999 for CH, LT, PL and SI, 1998 for E, EL, IS, MT and NL, and 1997 for NO and TR. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States, as results from CIS3 are not yet available.

Definition

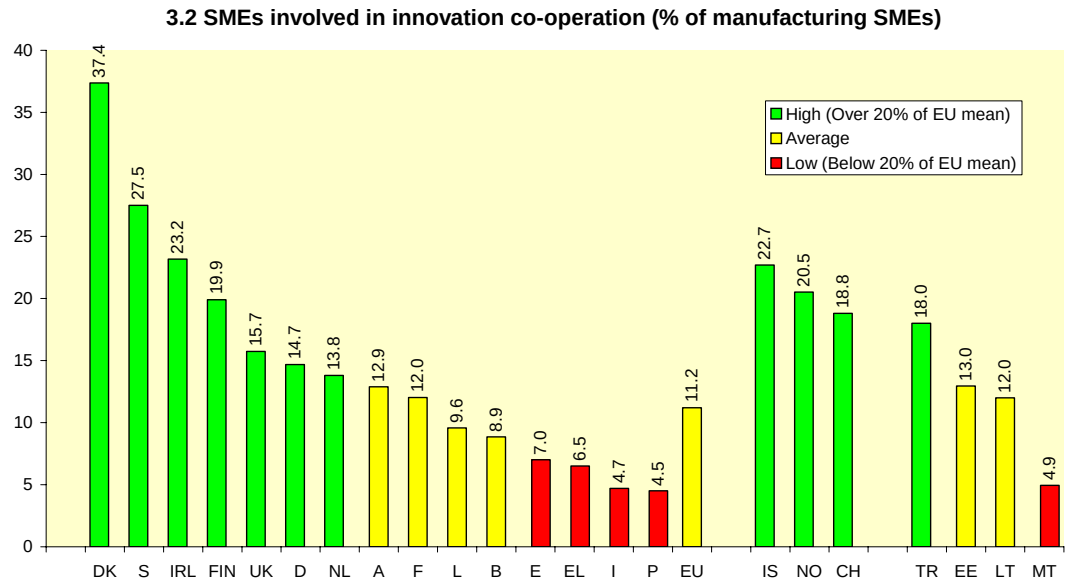
Innovative manufacturing firms are defined as those who introduced new products or processes either:
2. In-house or
3. In combination with other firms

Note: This indicator does not include new products or processes developed by other firms (option 1 in the CIS questionnaires; compare question 2 in the CIS 2 questionnaire and question 2.1 in the CIS 3 questionnaire). Only SMEs with 20-249 employees are taken into account in CIS 2. Small and medium-sized enterprises (SMEs) are characterised as those enterprises with 20-249 employees.

Interpretation

The CIS defines innovative manufacturing firms quite broadly as those who introduced new products or processes developed by 1) other firms, 2) in house, or 3) in combination with other firms. The present indicator is more focused in two respects. It is limited to SMEs because almost all large firms innovate and because countries with an industrial structure weighted to larger firms would tend to do better. And it is limited to firms with in-house innovative activities that either develop product or process innovations themselves or in combination with other firms.

3.2 Manufacturing SMEs involved in innovation co-operation



Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, IE, NO, EE, LT, MT and TR; years used: 1996 for all countries, except 2000 for EE, 1999 for CH, 1998 for E, EL, IS, LT, MT and NL, and 1997 for NO and TR. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States, as results from CIS3 are not yet available.

Definition

The indicator is the percentage of all manufacturing SMEs (including non-innovators) with 20 or more employees that had any co-operation agreements on innovation activities with other enterprises or institutions in the three years before the survey (compare question 11 in the CIS 2 questionnaire and question 8.1 in the CIS 3 questionnaire).

Interpretation

Complex innovations, particularly in ICT, often depend on the ability to draw on diverse sources of information and knowledge, or to collaborate on the development of an innovation. This indicator measures the flow of knowledge between public research institutions and firms and between firms and other firms. The indicator is limited to SMEs because almost all large firms are involved in innovation co-operation. This indicator also captures technology-based small manufacturing firms, since most are involved in co-operative projects. However, the indicator will miss high-technology firms with no product sales, such as many biotechnology firms, because these firms are assigned to the service sector.

3.3 Innovation expenditures (% of all turnover in manufacturing)

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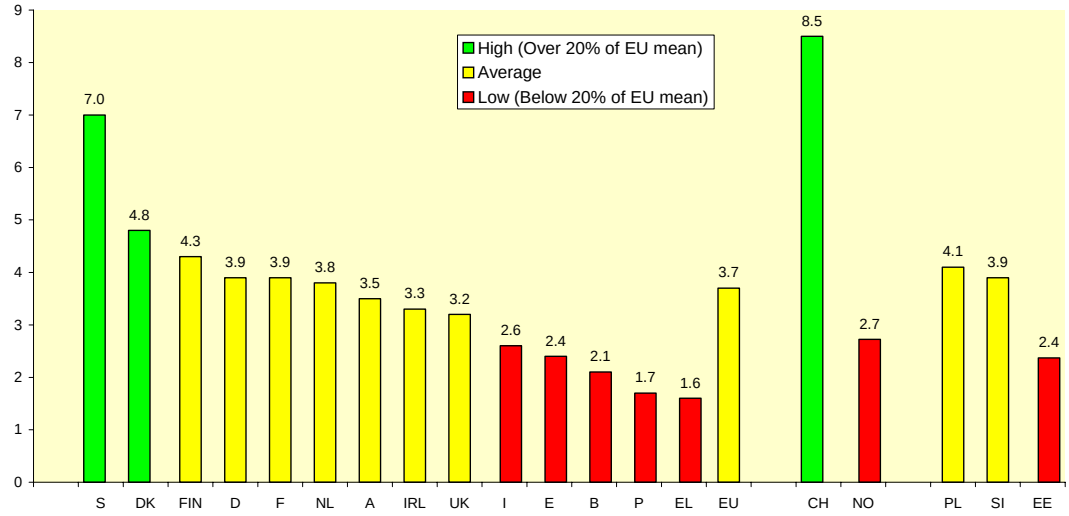


Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, NO and EE; years used: 1996 for all countries, except 2000 for EE, 1999 for CH, PL and SI, 1998 for D, E and EL, and 1997 for NO. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States, as results from CIS3 are not yet available.

Definition

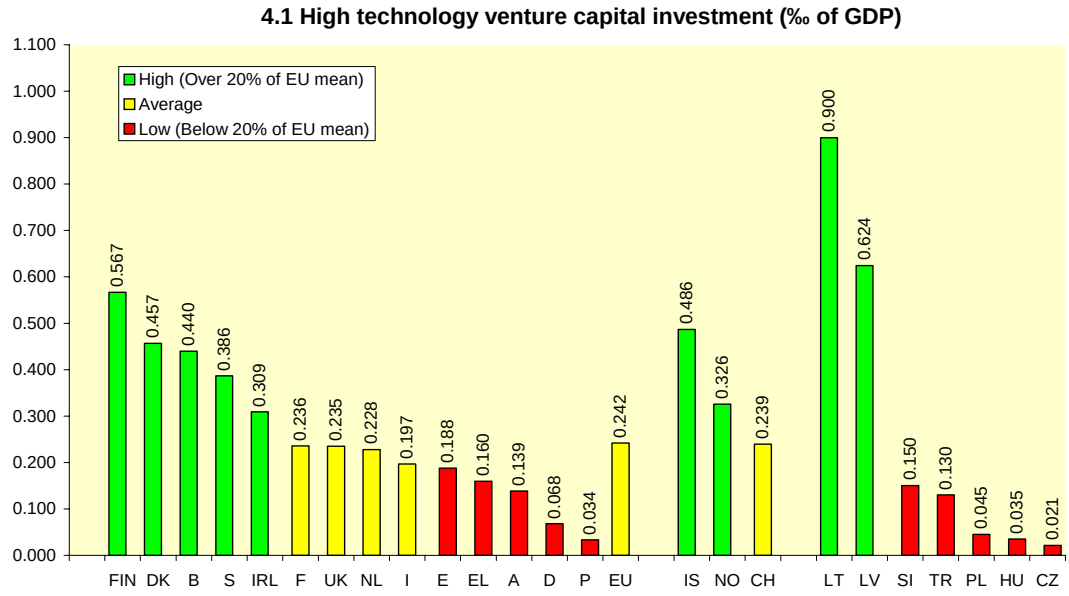
This indicator includes all manufacturing firms with 20 or more employees. Innovation expenditures includes the full range of innovation activities: in-house R&D, extramural R&D, machinery and equipment linked to product and process innovation, spending to acquire patents and licenses, industrial design, training, and the marketing of innovations. Total innovation expenditure by all firms in each country is divided by total turnover. This includes firms that do not innovate, whose innovation expenditures are zero by definition (compare question 6 in the CIS 2 questionnaire and question 4.1 in the CIS 3 questionnaire).

Interpretation

Several of the components of innovation expenditure, such as investment in equipment and machinery and the acquisition of patents and licenses, measure the diffusion of new production technology and ideas. Overall, the indicator measures total expenditures on many different activities of relevance to innovation. The indicator partly overlaps with indicator 2.2 on R&D expenditures. A better version would exclude R&D, but concerns over data reliability have prevented this option.

4. Innovation finance, output and markets

4.1 High-tech venture capital investment (‰ of GDP)



Sources: European Private Equity & Venture Capital Association (EVCA); GSO survey for HU, LT, LV and TR; years used: 2001 for all countries, except 2000 for D, and 1999 for CZ, PL and SI.

Definition

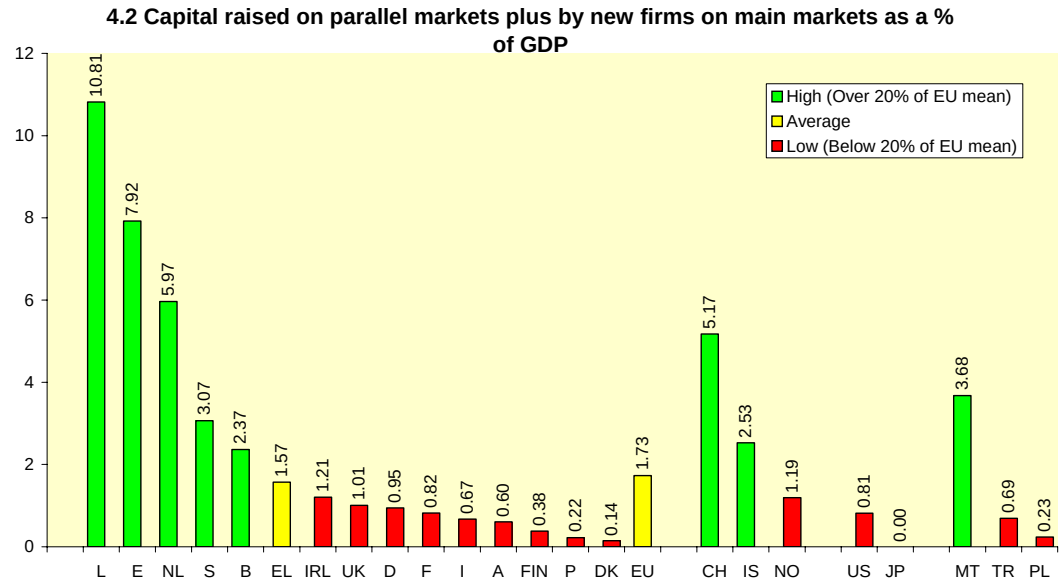
The percentage of GDP due to venture capital in high technology firms active in the following sectors: computer related fields, electronics, biotechnology, medical/health, industrial automation, financial services. Venture capital is the sum of early stage capital (seed and start-up) plus expansion capital.

The data for this indicator were taken from EVCA's "Mid-Year Survey of Pan-European Private Equity & Venture Activity". More recent data for high-tech venture investments including replacement and buyout capital are available in EVCA's "Yearbook: Annual Survey of Pan-European Private Equity & Venture Capital Activity". The Yearbook however does not provide disaggregated data to calculate high-tech venture capital investments according to the EIS definition and these data have thus not been used.

Interpretation

One of the main barriers to innovation is the ability of new technology-based firms to raise adequate funding. This indicator measures the supply of private venture capital to these firms. The total supply of capital will be higher because of bank and private-placement financing. The main disadvantage is that there are many alternative methods of financing new technology-based start-up firms that are not covered by this indicator. Firms can also go abroad to raise venture capital. An additional concern is the lack of information on the accuracy of the venture capital data.

4.2 New capital raised on stock markets (% of GDP)



Source: World Federation of Stock Exchanges (FIBV); years used: average of 2000 and 2001 for all countries, except average of 1999 and 2000 for PL.

Definition

This indicator is the amount of new capital raised by domestic firms on domestic stock markets as a percentage of GDP. It excludes investment funds and unit trusts. And, in order to focus the indicator on new innovative firms, the indicator excludes capital raised by existing firms on the main stock exchanges. Three types of new capital are included:

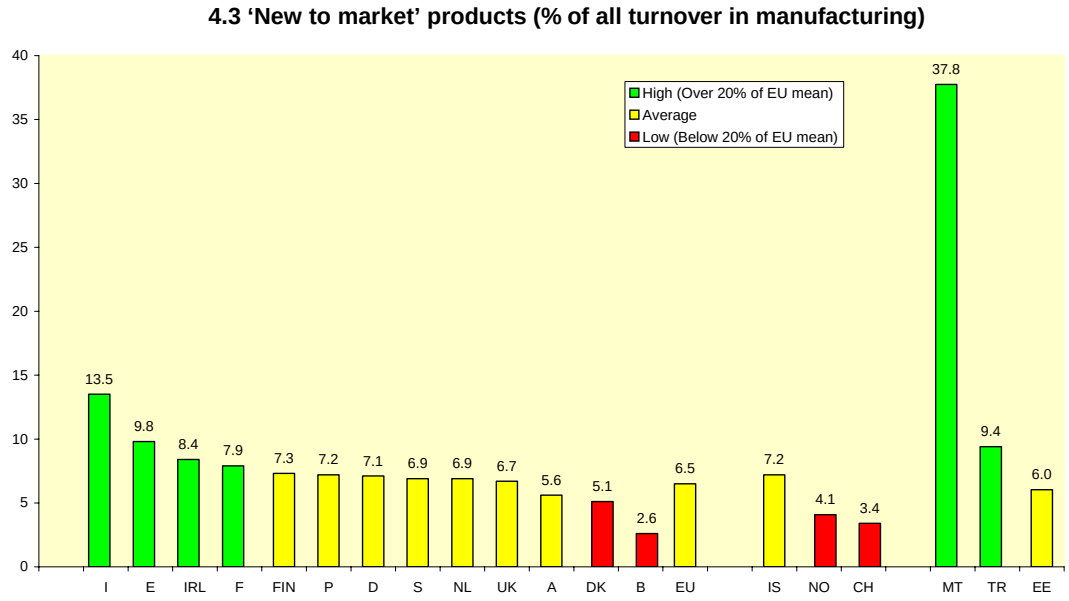
- capital raised by newly admitted firms to the main stock exchanges
- capital raised on parallel markets by already listed firms
- capital raised on parallel markets by newly admitted firms.

The focus on new capital that is probably raised by innovative firms in high technology sectors differentiates this indicator from the Structural indicator "Capital raised on stock markets", which includes all capital raised on stock markets, including capital raised on the main markets. Parallel stock exchanges focus on high technology sectors.

Interpretation

New capital is a major source of investment for many firms, but particularly for fast growing firms in high technology sectors. The indicator is strongly influenced by volatility in capital markets: it includes stocks that have little to do with technology. Firms raising capital in foreign markets will distort the results.

4.3 'New to market' products (% of sales by manufacturing firms)



Sources: EUROSTAT, Community Innovation Survey; GSO survey for CH, IS, NO, EE, MT and TR; years used: 1996 for all countries, except 2000 for EE, 1999 for CH and MT, 1998 for D, E and IS, and 1997 for NO and TR. Note that this indicator has not been updated in the 2002 Scoreboard for the Member States as results from CIS3 are not yet available.

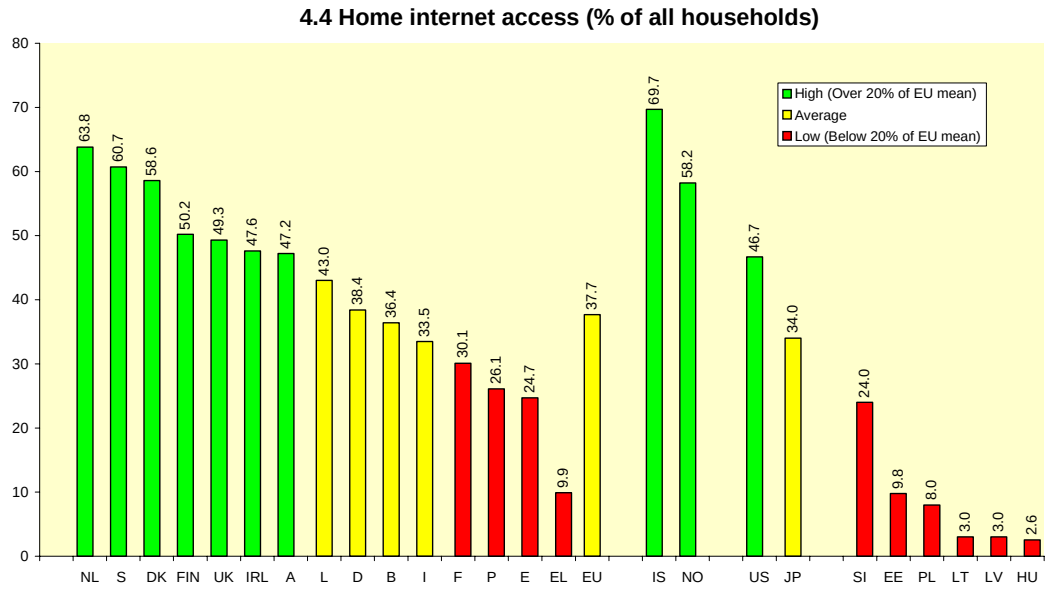
Definition

The amount of product sales (or total turnover), by manufacturing firms with more than 20 employees, from innovations that are new to the firm's market. These are limited to products that are both new to the firm itself and new to the firm's market. (compare question 5 in the CIS 2 questionnaire and question 1.4 in the CIS 3 questionnaire).

Interpretation

This is a direct output measure of innovation that is not distorted by market speculation (as would the market value of a firm). The product must be new to the firm, which in many cases will also include innovations that are world-firsts. The main disadvantage is that there is some ambiguity in what constitutes a 'new to market' innovation. Smaller firms or firms from less developed countries could be more likely to include innovations that have already been introduced onto the market elsewhere.

4.4 Home internet access (% of all households)



Sources: EUROSTAT/Eurobarometer; GSO survey for EE, HU and LV; years used: 2001 for all countries, except 2000 for JP, HU and LV.

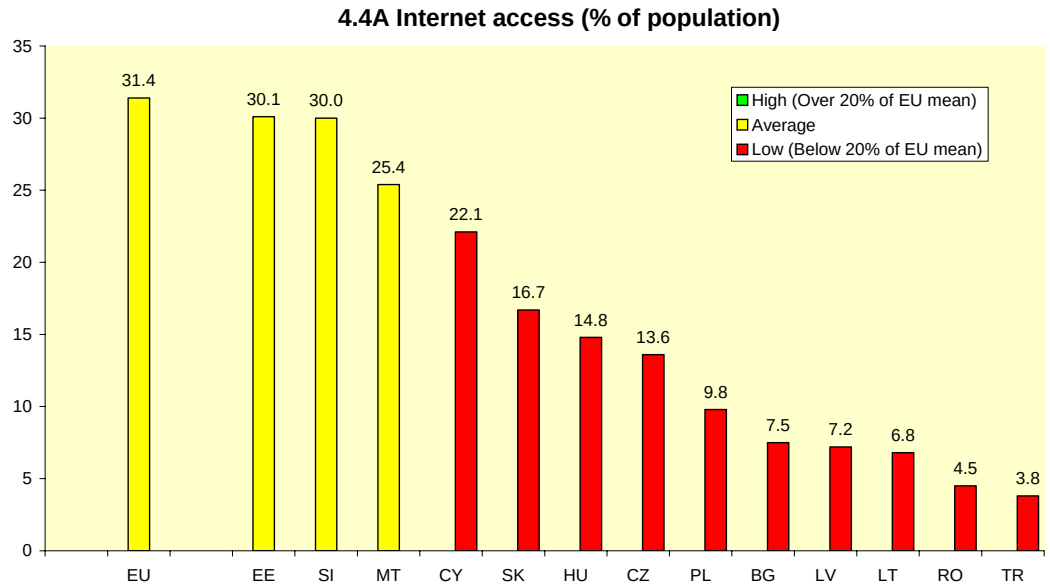
Definition

Percentage of households who have internet access at home. All forms of use are included. Population considered is equal to or over 15 years old. This indicator is identical to Structural indicator 2.3: Level of internet access.

Interpretation

Internet use by the domestic population is a measure of the ability to access an enormous wealth of data on-line, including business-to-consumer e-commerce and government-to-citizen online services. In the future, much more sophisticated measures of internet use will be needed. Better data is needed on what the internet is used for and if the population is aware of several efficiency enhancing uses.

4.4A Internet access (% of population)



Source: EUROSTAT; years used: 2001 for all countries.

Definition

Percentage of population with any form of internet access. All forms of use are included. Population considered is equal to or over 15 years old.

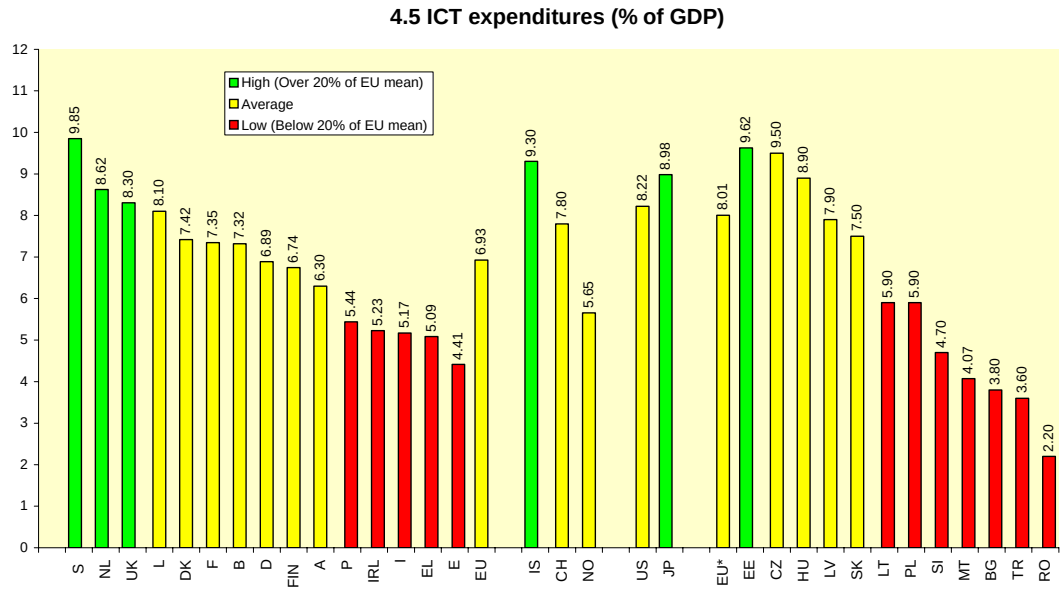
Interpretation

Internet use by the domestic population is a measure of the ability to access an enormous wealth of data on-line, including business-to-consumer e-commerce and government-to-citizen online services. In the future, much more sophisticated measures of internet use will be needed. Better data is needed on what the internet is used for and if the population is aware of several efficiency enhancing uses.

Candidate countries

This indicator is used as an alternative for indicator 4.4 due to better data availability.

4.5 ICT expenditures (% of GDP)



Sources: EUROSTAT; WITSA/IDC (Digital Planet) for Candidate countries and EU*; GSO survey for IS and MT; years used: 2001 for all countries, except 2000 for LT, LV, MT, JP and US.

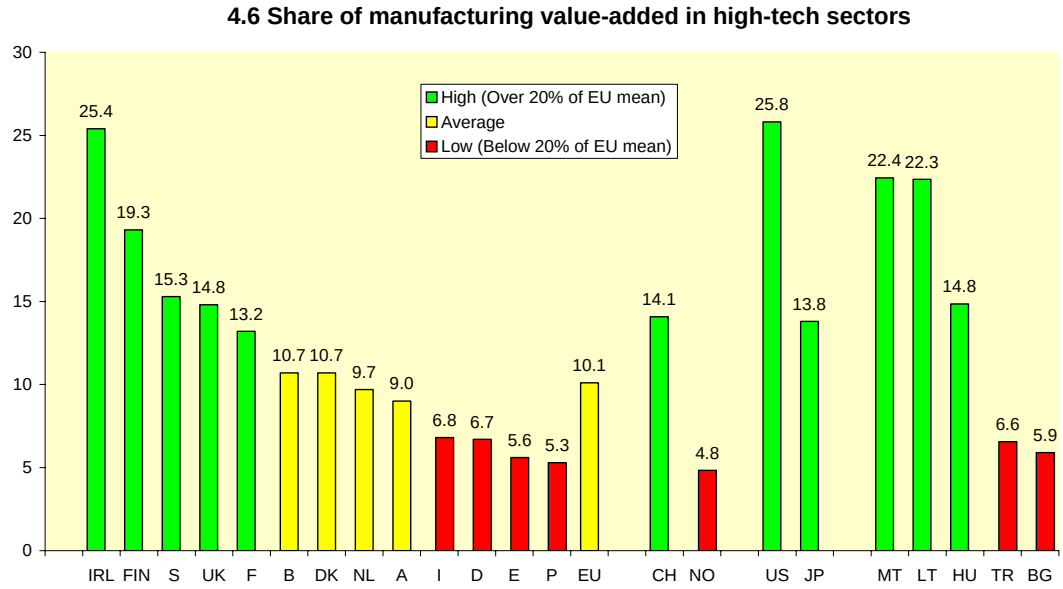
Definition

This indicator measures total expenditures on Information and Communication Technology (ICT) as a percentage of GDP. ICT includes office machines, data processing equipment, data communication equipment, and telecommunications equipment, plus related software and telecom services. This indicator is identical to Structural indicator 2.7.

Interpretation

ICT is a fundamental feature of knowledge based economies and the driver of current and future productivity improvements. An indicator for ICT investment is crucial for capturing innovation in knowledge-based economies, particularly due to the diffusion of new IT equipment, services, and software. One disadvantage of this indicator is that it is ultimately obtained from private sources (IDC), with a lack of good information on the reliability of the data. Another disadvantage is that some expenditures are for final consumption and may have few productivity or innovation benefits. It would be preferable to have data on ICT investment rather than ICT expenditure, but reliable investment data are not yet available.

4.6 Percent of manufacturing value-added from high technology



Sources: EUROSTAT, Structural Business Statistics; GSO survey for CH, NO, BG, EE, HU, LT, MT, TR; years used: 1999 for all countries, except 2000 for BG, HU and TR, 1998 for LT and MT, and 1997 for JP and US.

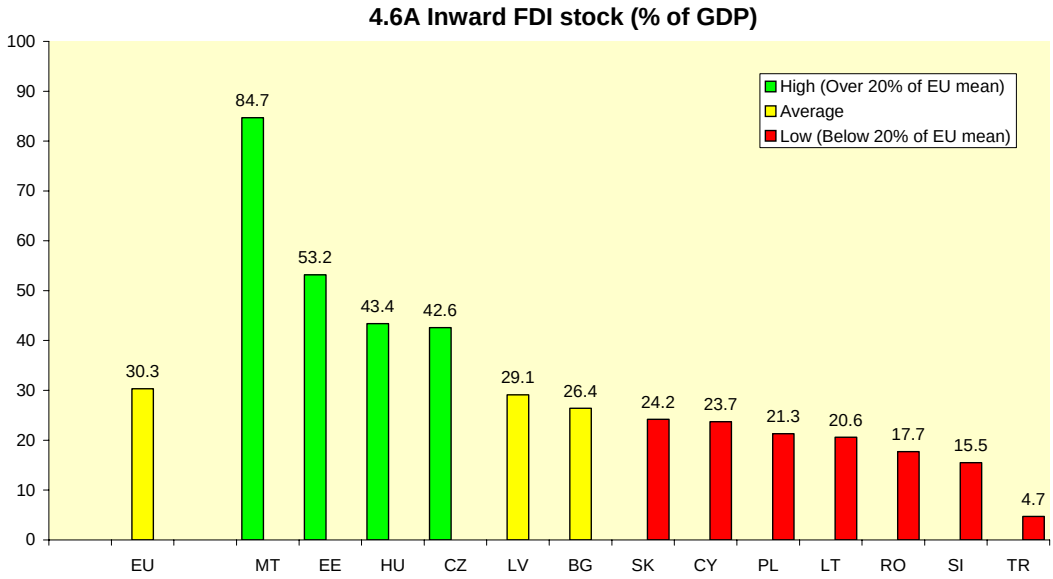
Definition

The percentage of total value added in manufacturing in four high technology industries: pharmaceuticals (NACE 24.4), office equipment (NACE 30), telecommunications and related equipment (NACE 32), and aerospace (NACE 35.3).

Interpretation

Value-added is the best measure of manufacturing output, whereas other indicators such as total production can be biased by 'screwdriver' plants with little value-added. The requirement for good data on value added creates a lag of two or more years longer than for GDP and other economic data. The main disadvantage of the main indicator is that a hollowing-out of manufacturing, as in the UK, can lead to relatively good results, if low and medium technology industries no longer survive.

4.6A Stock of inward FDI (% of GDP)



Source: UNCTAD (World Investment Report); years used: 2000 for all countries.

Definition

The indicator is defined as the stock in inward Foreign Direct Investment (FDI) as a percentage of GDP. UNCTAD defines FDI "as an investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise or affiliate enterprise or foreign affiliate). FDI implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. Such investment involves both the initial transaction between the two entities and all subsequent transactions between them and among foreign affiliates, both incorporated and unincorporated."

Interpretation

The inflow of FDI steers production towards higher value-added goods, or increases production efficiency. Both can depend on the transfer of foreign technology and provide a potential for conducting industrial research in the host country. Stock data are a better proxy for the rate of penetration of FDI and also neutralize large variations in annual inflows.

Candidate countries

This indicator is used as an alternative for indicator 4.6.