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COMMISSION STAFF WORKING PAPER

EUROPEAN INNOVATION SCOREBOARD 2004
COMPARATIVE ANALYSIS OF INNOVATION PERFORMANCE

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COMPARATIVE ANALYSIS OF INNOVATION PERFORMANCE

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EXECUTIVE SUMMARY

This is the fourth edition of the *European Innovation Scoreboard* (EIS). The EIS is the instrument developed by the European Commission, under the Lisbon Strategy, to evaluate and compare the innovation performance of the Member States. The EIS 2004 includes innovation indicators and trend analyses for all 25 EU Member States, as well as for Bulgaria, Romania, Turkey, Iceland, Norway, Switzerland, the US and Japan. As in 2003 the EIS is part of a package together with the European competitiveness report and the enterprise scoreboard. The choice of indicators for the EIS has been co-ordinated with the "structural indicators" and with the research policy indicators published in the Key Figures[1] and in "Investing in Research; an action plan for Europe[2]." The annex includes tables with definitions as well as comprehensive data sheets for every country.

Summary Innovation Index

The EIS is based on 20 indicators. They are combined into a composite indicator, the Summary Innovation Index (SII), which provides an overview of the relative national innovation performances. The SII is calculated for all countries, based on a number of available indicators, which can vary from 12 to 20 depending on the country. Ideally, one would like to compare all countries using all indicators in one SII. However, data are unavailable for a number of indicators for several new Member States, the Applicant Countries, the US and Japan. Consequently, the innovation rankings based on the 2004 SII need to be interpreted with caution. Furthermore, the SII is a relative instead of an absolute ranking. Having an SII twice that of another country does not mean that the absolute innovation performance is also twice as good.

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1 "Towards a European Research Area - Science, Technology and Innovation - Key Figures 2003-2004"; Luxembourg: OPOCE, 2003 – 96 pp. ISBN 92-894-5814-3, ISSN 1725-3152

2 "Investing in Research ; an action plan for Europe", Luxembourg: OPOCE, 2003 – 76 pp. ISBN 92-894-5909-3 – known as the "3% Action Plan"

The gap between the US and the EU still exists

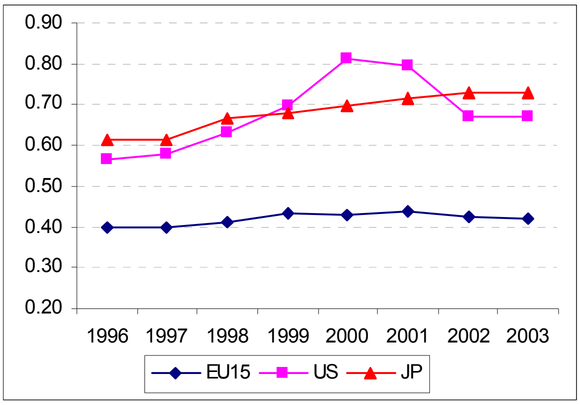
Based on a set of comparable data for 12 indicators, the US and Japan are still far ahead of the EU average and the vast majority of Member States (see Figure I).

The innovation gap between the US and the EU, as well as the gap between Japan and EU, still exist. This innovation gap is measured, based on 12 common indicators.

The EU innovation performance, as measured by the European Innovation Scoreboard, has been relatively constant since 1996, whereas the innovation performance in the US and Japan has further improved, thus widening the gap.

The peak in the US performance innovation in 2000 & 2001 is due to the venture capital indicator.

Figure I : Gap between the US and the EU measured by the SII



The gap between the US and the EU can be largely explained by 3 indicators:

– Patents (50 % of the gap)

– Working population with tertiary education (26 %)

– R&D expenditures (11%) – mainly business R&D

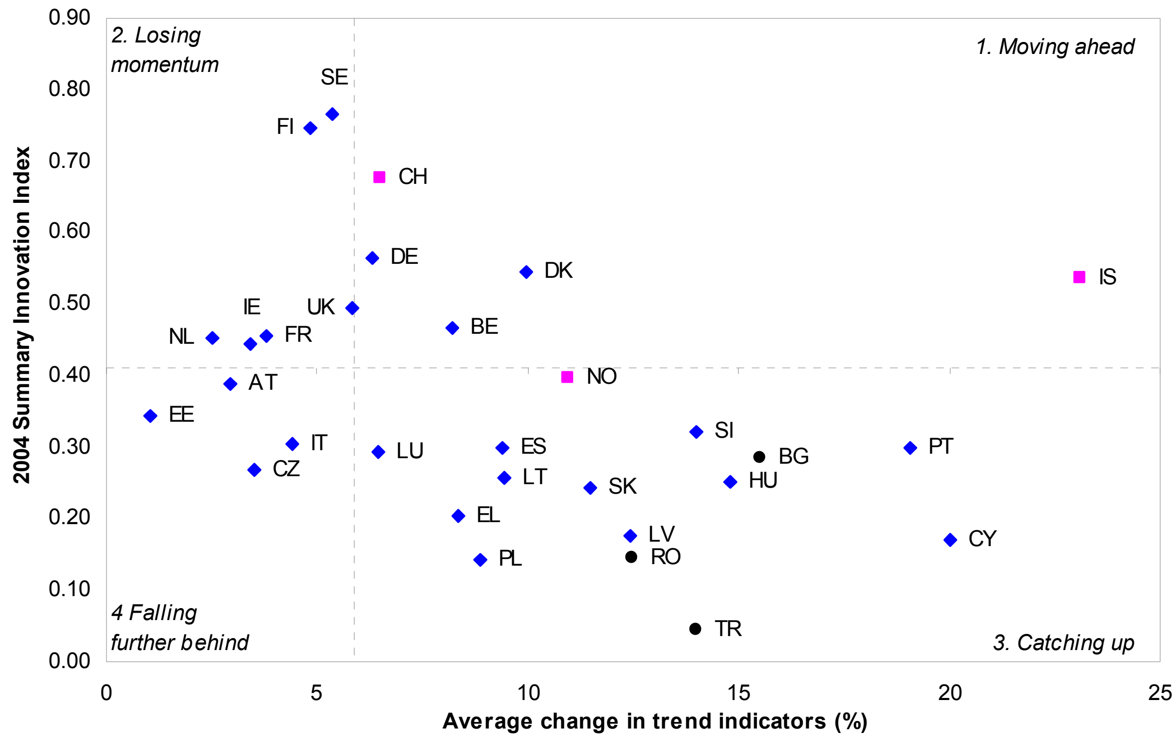
Development of national innovation performances

With respect to the situation in the European Union, significant national differences are still observed. Figure II shows the SII on the vertical axis and the average trend performance on the horizontal axis. Countries above the horizontal dotted line currently have an innovation performance above the EU25. The trend for countries to the right of the vertical dotted line improved faster than the average EU25 trend. The SII provides an overview of the relative innovation performance of each country.

Sweden and Finland confirm their leadership, in terms of innovation performance, although at near average trends. Germany and Denmark also perform well above the EU average, with Denmark moving ahead more quickly. Other leading countries, such as the Netherlands, Ireland and France are losing momentum.

Most of the new Member States are catching up, however coming from relatively low levels. Older Member States such as Portugal, Spain or Greece are also catching up following the same model. A few Member Sates are falling further behind, including Austria, Estonia, Italy or the Czech Republic.

Figure II. Average country trend by Summary Innovation Index

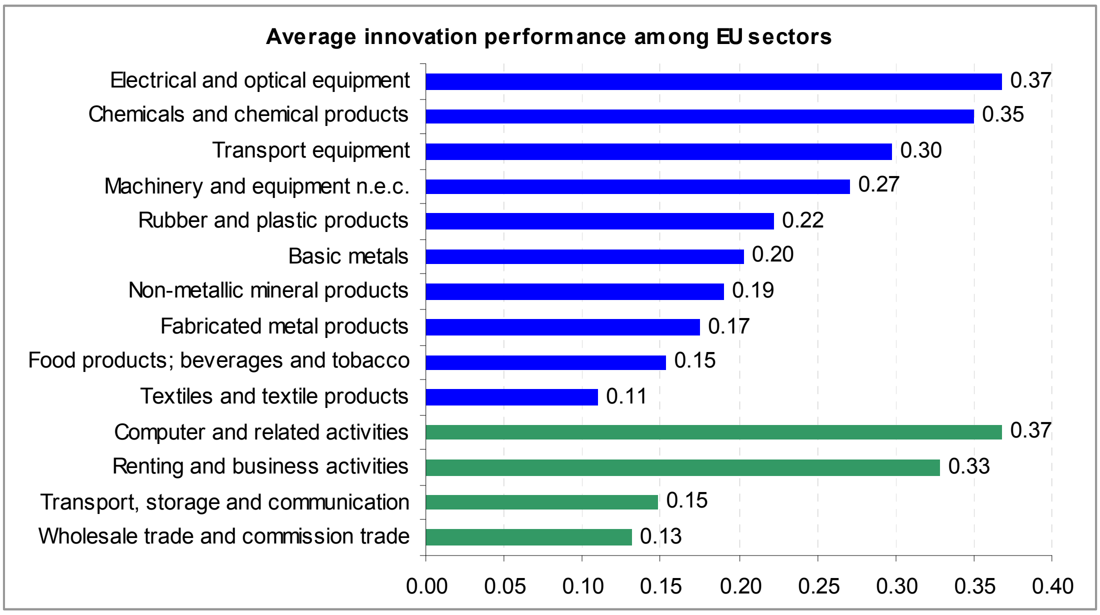


otted lines show EU25 mean performance

Innovation by sector

Using results from the latest Community Innovation Survey the EIS 2004 examines for the first time innovation differences between sectors (See Figure III). As expected, there are large differences in the innovativeness of specific sectors. The most innovative sector in the EU is electrical and optical equipment while the least innovative is textiles and textile products. In addition, there are large differences across Member States in the innovativeness of specific sectors. The electrical equipment sector for example is most innovative in Finland while Germany leads in transport equipment. The sector analyses also show marked differences in innovation styles, with 'high' and 'medium-high' technology manufacturing sectors innovating through knowledge creation, while service sectors and low technology manufacturing stress knowledge diffusion.

Figure III. Innovation Sector Index (ISI)



Outlook

The EIS 2004 explores for the first time three new themes: non-technological innovation, sector specific innovation and differences between types of innovators and innovation modes. A more detailed analysis of this kind will allow developing targeted innovation policies that are essential to improve the competitiveness of specific sectors, such as the textile, chemical, and transport industries. At the national and the European level such policies depend on the ability of the Member States to provide better and more reliable statistical data under the Community Innovation Survey. Developing sector specific innovation policies will be one of the priorities under the forthcoming innovation action plan.

1. INTRODUCTION

The Lisbon European Council of 2000 established the strategic goal for the European Union to become the most competitive and dynamic knowledge-based economy in the world by 2010, with sustainable economic growth, more and better jobs, and greater social cohesion. Innovation was recognised to be at the heart of the Lisbon process and the Lisbon Council asked the European Commission to develop and annually publish a European Innovation Scoreboard (EIS). The present document is the fourth edition of the EIS since 2000.[3]

The EIS relies to a large extent on data from the third European Community Innovation Survey (CIS). This survey is the most important European source for dedicated innovation statistics and it is gradually being adopted by other European and non-European OECD countries. However, because the survey is conducted every four years, data from the latest CIS refer to innovation between 1998 and 2000. Since September 2004 the CIS has become legally binding[4] and significant improvements of CIS methodology and timeliness are currently underway. Consequently, in the future some of the CIS data should become available on a bi-annual basis.

For the purpose of this working paper, innovation is defined as "the renewal and enlargement of the range of products and services and the associated markets; the establishment of new methods of production, supply and distribution; the introduction of changes in management, work organization, and the working conditions and skills of the workforce[5]

To measure innovation performance, the EIS uses official statistics. The choice of indicators for the EIS has been co-ordinated with the "structural indicators" and the "R&D key figures".

The EIS 2004 covers the 25 EU Member States, Bulgaria, Romania and Turkey, the associate countries Iceland, Norway and Switzerland, as well as the US and Japan. The indicators of the EIS summarise the main drivers and outputs of innovation. These indicators are divided into four groups:

- Human resources for innovation (5 indicators);
- The creation of new knowledge (4 indicators);
- The transmission and application of knowledge (4 indicators); and
- Innovation finance, output and markets (7 indicators).

The tables in the Annex give definitions, sources and results for all indicators. In depth analysis of sectoral innovation, innovation modes, and the methodology are provided in the "Technical Papers" that accompany the EIS.[6] For several countries updated CIS3 data has

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3 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), the second in December 2002 (SEC(2002) 1349), the third in November 2003 (SEC(2003) 1255)

4 Commission regulation on Innovation statistics (No 1450/2004)

5 COM(1995) 688

6 Table A in the Annex 1 provides a brief definition and the source of each indicator. Full definitions are available in the Methodology Report. Compared to 2003, some minor changes were necessary due to

been released by Eurostat after the publication of the EIS 2003. This means that for some of the new Member States and Germany CIS3 data will be different from those presented in the EIS 2003.

A new indicator concerning "non-technical change" has been integrated into the EIS 2004. This composite indicator measures three innovative activities that complement technological innovation: changes in organisational structures, management techniques, and product design. This new indicator reflects the emphasis of recent European Commission policy documents regarding the need to broaden the definition of innovation in order to better capture the reality of innovation processes in enterprises.[7]

2. THE 2004 SUMMARY INNOVATION INDEX

As in previous years, the EIS 2004 offers, as a composite indicator, a Summary Innovation Index (SII). The SII gives an "at a glance" overview of aggregate national innovation performances. More detailed information on the strengths and challenges of each country are included in the Annex country pages. The methodology of the SII is discussed in the related technical paper (see www.trendchart.org).

Figure 1 shows the results for the 2004 SII[8]. As measured by the EIS indicators, Sweden and Finland remain the innovative leaders within the EU. Estonia and Slovenia lead the EU10 group of the new Member States. They approach the EU25 average and rank above a number of EU15 countries. Some significant changes in national performances and the development of the Union vis-à-vis the US are discussed below.

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data availability. Indicator 4.7 of the EIS 2003 on volatility rates has been cancelled due to limited data availability. For indicator 2.3.2 – USPTO high-tech patents – the definition has changed from patent applications to patents granted. Composite indicator 4.4 – Internet access – now combines Internet access by households and enterprises. This change was necessary because data used in 2003 for SMEs with a website are not available for the new Member States. Annex Table B gives complete data for each indicator and all countries. With some exceptions, most indicators are available for the same year across all countries. Annex Table C lists the year of the most recent data for each indicator by country. Annex Table D shows trend performances for 13 indicators for which time series data are available and Annex Table E gives the years used to calculate the base trend value for each indicator. The calculation method for trends is described in the Technical Annex. Annex Table F gives separate data for manufacturing and services for indicators 3.1, 3.2, 3.3, 3.4, 4.3.1 and 4.3.2. Trends are calculated by comparing current performance to the base trend.

7 "Innovation Policy: Updating the Union's approach in the context of the Lisbon strategy" COM(2003) 112 and "Innovate for a competitive Europe – A new Action Plan for Innovation" SEC

8 The SII provides an overview of the relative innovation performance of each country. Ideally, one would like to compare all countries using all indicators in one SII. However, data are unavailable for a number of indicators for several new member states, the applicant countries, the US and Japan. Consequently, the innovation rankings based on the 2004 SII need to be interpreted with care. Furthermore, the SII is a relative instead of an absolute ranking. Having an SII twice that of another country does not mean that the absolute innovation performance is also twice as good.

Figure 1. The 2004 Summary Innovation Index (SII)

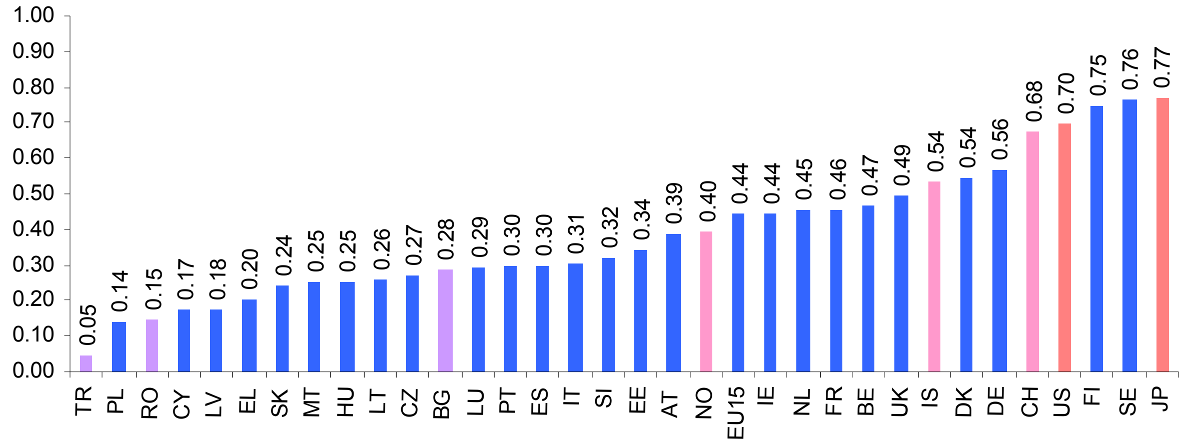
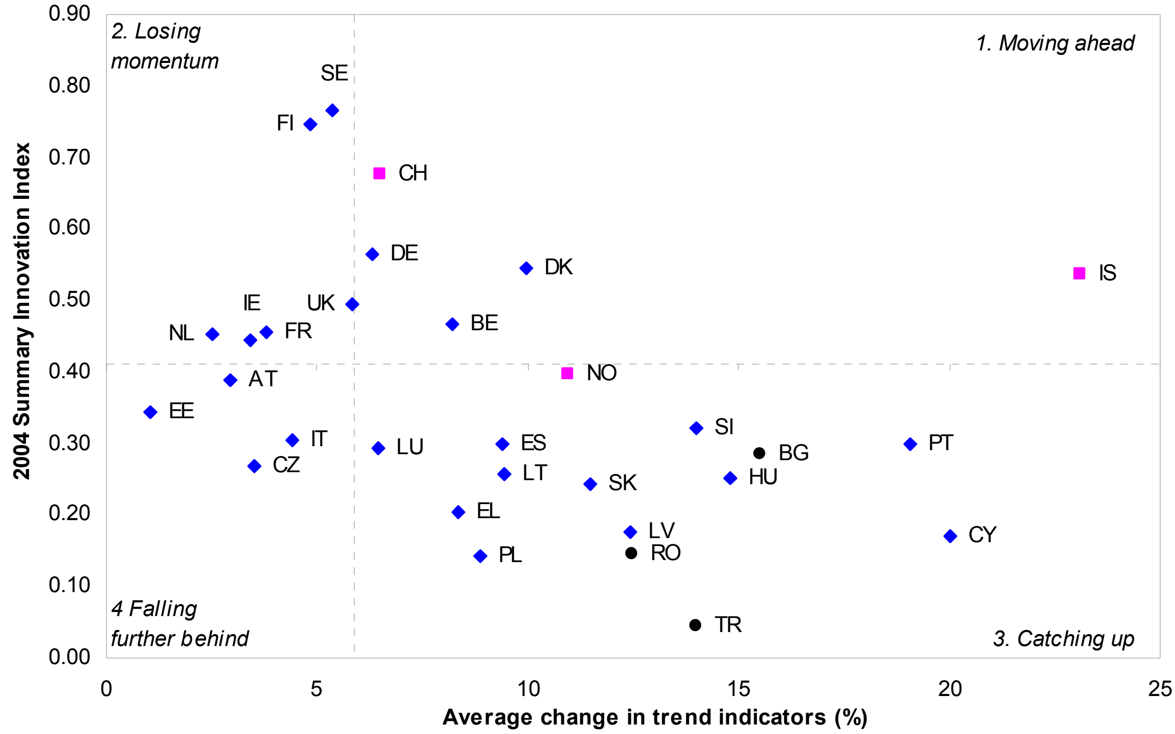


Figure 2. Average country trend by SII



Dotted lines show EU25 mean performance

Figure 2 graphs the current performance as shown by the SII (vertical axis) against the *medium-term* trend performance (horizontal axis) for 30 countries for which trend data are available[9]. This creates four quadrants: countries above both the average EU trend and the average EU SII are *moving ahead*, countries below the average SII but with an above average trend performance are *catching up*, countries with a below average SII and a below average trend are *falling further behind*, and countries with an above average SII and a below average trend are *losing momentum*.

Portugal, Latvia, Cyprus, Hungary, Slovakia, Spain, Slovenia, Luxembourg and Poland are situated in the "catching up" quadrant. Of note, the strong positive trends in most new Member States are partly due to very low starting values for a few indicators. Some indicators, particularly for patenting, can also be very volatile as demonstrated by the significant drop in trend performance for Estonia as compared to last year. Slovenia maintains a strong trend performance combined with a current performance close to the EU25 average. Iceland and Denmark are "moving ahead" with above average values for current performance and trend. Finland and Sweden are the top performers on the SII but with below average trends. Both countries have recently adjusted their policy priorities towards faster growth in order to make their superior innovation performance sustainable. The situation in the Netherlands, France and Ireland appears to be less advantageous because trend rates in these countries are quite far below the EU average.

3. INNOVATION PERFORMANCE AND TRENDS BY COUNTRIES – EU/US

Table 1 identifies, for each indicator, the three best performing Member States and the results for the US and Japan. The Nordic countries of Finland, Sweden and Denmark take up more than 50% of the leading slots. Germany (nine leading slots) is clearly ahead among the larger EU countries. The new Member States lead in employment in medium/high-tech manufacturing, innovation expenditures, ICT expenditures and high-tech manufacturing value-added. They take up more than 10% of the leading slots.

The EU leaders are ahead of the US for nine out of 12 indicators and ahead of Japan for seven out of 11 indicators. However, the US outperforms the EU average performance in 9 out of 12 indicators.

The gap between the US and the EU is further expanding and according to the EIS, the main factors underlying this gap are:

– Patents (50 % of the gap)

– Working population with tertiary education (26 %)

– R&D expenditures (11%) – mainly business R&D

– High-tech manufacturing value-added share (11%)

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9 Trend calculations compare the latest available year with the average of three previous years after a one year lag (see the Technical Paper on methodology). For Malta an average country trend could not be calculated as this requires trend data for at least 7 indicators. All trend results are presented in table D in the Annex. The Technical Annex gives more detailed information on the definitions of indicator trends and average country trends.

– Early stage venture capital (10%)

The EU has an advantage over the US for the Employment in med/high-tech and S&E graduates (-8%), and is on the same level for ICT expenditures.

Table 1. Performance leaders for each indicator

No	Indicator	EU25	EU15	European leaders			US	JP
1.1	S&E graduates / 20-29 years	11.5	12.5	20.5 (IE)	20.2 (FR)	19.5 (UK)	10.2	13.0
1.2	Population with tertiary education	21.2	21.8	33.2 (FI)	31.9 (DK)	30.6 (UK)	38.1	36.3
1.3	Participation in lifelong learning	9.0	9.7	34.2 (SE)	21.3 (UK)	18.9 (DK)	--	--
1.4	Employment in med/high-tech manufacturing	6.60	7.10	11.04 (DE)	8.94 (SI)	8.71 (CZ)	4.65	--
1.5	Employment in high-tech services	3.19	3.49	4.85 (SE)	4.68 (FI)	4.50 (DK)	--	--
2.1	Public R&D / GDP	0.67	0.69	1.04 (FI)	0.95 (SE)	0.83 (FR)	0.86	0.80
2.2	Business R&D / GDP	1.27	1.30	3.32 (SE)	2.37 (FI)	1.75 (DK)	2.03	2.32
2.3.1	High-tech EPO patents / population	26.0	30.9	120.2 (FI)	93.0 (NL)	74.7 (SE)	48.4	40.4
2.3.2	High-tech USPTO patents / population	9.4	11.2	51.4 (FI)	38.1 (SE)	16.4 (DK)	76.4	75.4
2.4.1	EPO patents / population	133.6	158.5	311.5 (SE)	310.9 (FI)	301.0 (DE)	154.5	166.7
2.4.2	USPTO patents / population	59.9	71.3	187.4 (SE)	158.6 (FI)	137.2 (DE)	301.4	273.9
3.1	SMEs innovating in-house	31.7	32.1	46.2 (DE)	39.2 (LU)	38.3 (BE)	--	--
3.2	SMEs involved in innovation co-operation	7.1	6.9	20.0 (FI)	15.8 (DK)	13.4 (SE)	--	--
3.3	Innovation expenditures / turnover	2.15	2.17	8.09 (SK)	2.72 (DE)	2.65 (BE)	--	--
3.4	SMEs being non-technical innovators	43	--	74 (LU)	65 (DE)	59 (EL)		
4.1	High-tech venture capital share	--	50.8	69.8 (DK)	63.4 (DE)	57.4 (FR)	--	--
4.2	Early stage venture capital / GDP	--	0.025	0.081 (SE)	0.065 (FI)	0.063 (DK)	0.072	--
4.3.1	Sales 'new to market' products / turnover	5.9	5.9	14.5 (FI)	10.8 (PT)	9.5 (IT)	--	--
4.3.2	Sales 'new to firm' products / turnover	16.9	17.2	23.4 (DE)	17.5 (FI)	17.0 (ES)	--	--
4.4	Composite indicator on Internet access[10]	--	0.57	1.00 (SE)	0.89	0.77 (NL)	--	1.02

[10] The composite indicator on Internet access combines Eurostat data on Internet access by enterprises and households. The unweighted average of both indicators is rescaled so that the best performing

					(DK)			
4.5	ICT expenditures / GDP	6.3	6.2	11.5 (EE)	10.1 (LV)	9.4 (HU)	6.3	6.1
4.6	High-tech manufacturing value-added share	12.7	14.1	30.6 (IE)	28.4 (MT)	24.9 (FI)	23.0	18.7

Table 2 presents country trends for up to 13 indicators for which time series data are available[11]. The new Member States take up 60% of the leading slots for trends. The strong trends in these countries are partly explained by the fact that they are improving from relatively low starting points. Portugal and Cyprus both occupy six leading slots followed by Ireland, Latvia and Slovakia. These countries also show the best average trends. The EU trend leaders are ahead of the US for all eleven indicators and ahead of Japan for all ten comparable indicators.

Table 2. Trend leaders (trends in %)

No	Indicator	EU25	EU15	European trend leaders			US	JP
1.1	S&E graduates / 20-29 years	18.5	16.5	107.7 (MT)	59.2 (SK)	49.7 (DK)	-3.3	3.8
1.2	Population with tertiary education	6.6	3.4	23.3 (PT)	21.9 (PL)	20.7 (IE)	6.8	14.2
1.3	Participation in lifelong learning	--	--	22.7 (LU)	21.4 (BE)	15.2 (ES)	--	--
1.4	Employment in med/high-tech manufacturing	-5.4	-6.7	18.6 (SK)	13.8 (CY)	7.6 (LV)	-8.5	--
1.5	Employment in high-tech services	0.2	2.6	20.7 (CY)	17.3 (AT)	11.7 (PT)	--	--
2.1	Public R&D / GDP	0.5	2.0	54.7 (HU)	30.0 (CY)	13.3 (LT)	25.2	-7.0
2.2	Business R&D / GDP	5.2	4.8	88.2 (PT)	54.5 (LV)	38.5 (CY)	-4.7	10.1
2.3.1	High-tech EPO patents / population	35.1	34.6	143.0 (SI)	133.0 (EL)	97.0 (HU)	34.7	31.4
2.3.2	High-tech USPTO patents / population	22.5[a]	22.5	123.1 (IE)	42.9 (ES)	36.8 (DE)	7.9	7.7
2.4.1	EPO patents / population	14.5	14.1	68.6 (SI)	54.2 (LV)	46.6 (PT)	14.6	28.1
2.4.2	USPTO patents / population	12.6[a]	12.6	63.8 (CY)	34.7 (PT)	29.1 (IE)	0.7	8.8
4.5	ICT expenditures / GDP	-2.9	-3.9	24.2 (LT)	14.1 (SK)	13.2 (PL)	-3.8	13.0
4.6	High-tech manufacturing value-added share	12.0[a]	12.0	19.1 (FI)	17.6 (DE)	16.0 (BE)	7.0	12.0
	Country average	5.9	5.4	20.0 (CY)	19.1 (PT)	14.8 (HU)	4.1	9.3

[a] Trend assumed to be equal to EU15 trend.

EU25 country has a value of 1.00, the worst performing country a value of 0.00. That for Japan is 1.02. This indicates that Japan is performing better than the best performing EU25 country. The composite indicator provides only a ranking. More details are available in the methodology report.

11 All trend results are presented in Annex Table C. For two indicators time series are only available for a very small number of the new member states: 1.3 Lifelong learning and 4.6 High-tech manufacturing value-added. For 2.3.2 USPTO high-tech patents no trend data are available for all new member states.

4. RELATIONSHIP BETWEEN GDP AND INNOVATION PERFORMANCE

This chapter examines the underlying correlation between GDP and innovation performance. The numbers, as they are used, do not provide a direct indication of causality between innovation and GDP. It must be noted that a time lag exists, and this can be primarily attributed to GDP data, which are based on a longer time period, whereas innovation performance data, as measured by the EIS, are based on a shorter time period.

Innovation is widely recognised as one of the key drivers of economic welfare. Figure 3 suggests a modest positive correlation coefficient ($r^2 = 0.77$; $t = 10.47$) between the SII and per capita GDP (in PPS, EU25=100) in 2003.[12] However, this picture becomes more complex if the countries are split into two groups, a high-income group above and a low-income group below the EU average GDP.[13] In this case, the correlation coefficient declines for both groups leading to a small correlation that is not statistically significant for the high-income group ($r^2 = 0.23$; $t = 0.96$) and a very moderate correlation for the low-income group ($r^2 = 0.39$; $t = 1.64$).

This phenomenon (which has also been identified in other studies using different measures of innovation) suggests that the relationship between income and innovation performance, and possible policy choices, become more differentiated at higher GDP levels. One explanation is that the reliance of most of the available innovation indicators on R&D fails to fully account for other factors, such as non-technical change or efficiency improvements due to the rapid adoption of new technology. These factors suggest that some countries may require differentiated policy strategies that can translate innovation into economic growth by placing, for example, more emphasis on non-technical change, the importance of which is discussed below.

Countries that combine a very high innovation performance with moderate GDP performance are particularly concerned by these results. The Swedish government recently created a “Growth Policy Institute” to provide advice for the integration of innovation and growth policies. Europe has taken similar steps with the Lisbon agenda and the creation of the “Competitiveness Council”.

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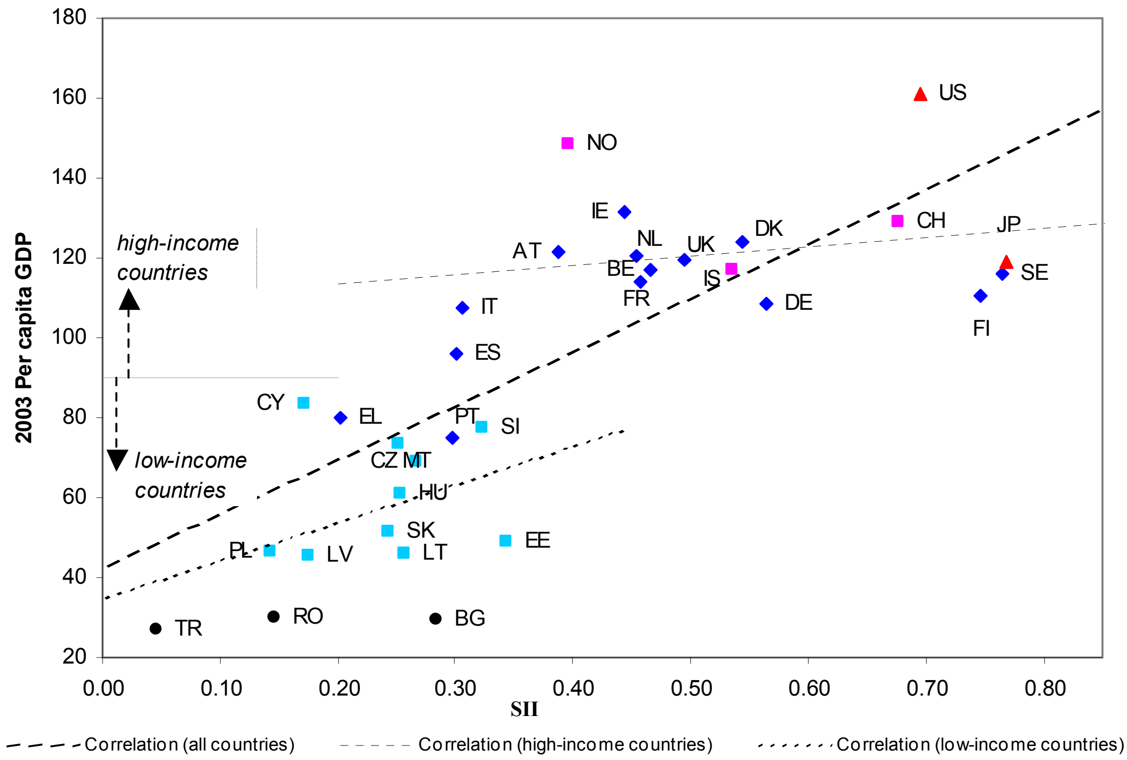
12 GDP in PPS (purchasing power standards). Luxembourg is removed as an outlier because of its exceptionally high GDP level (209). More in depth correlation analysis of innovation with other macro-economic indicators is included in the technical paper on methodology.

13 Low-income: TR, BG, RO, LV, LT, PL, EE, SK, HU, CZ, MT, PT, SI, EL, CY; High-income: ES, IT, DE, FI, FR, SE, BE, IS, JP, UK, NL, AT, DK, CH, IE, NO, US.

Figure 3. Correlation between innovation and per capita GDP



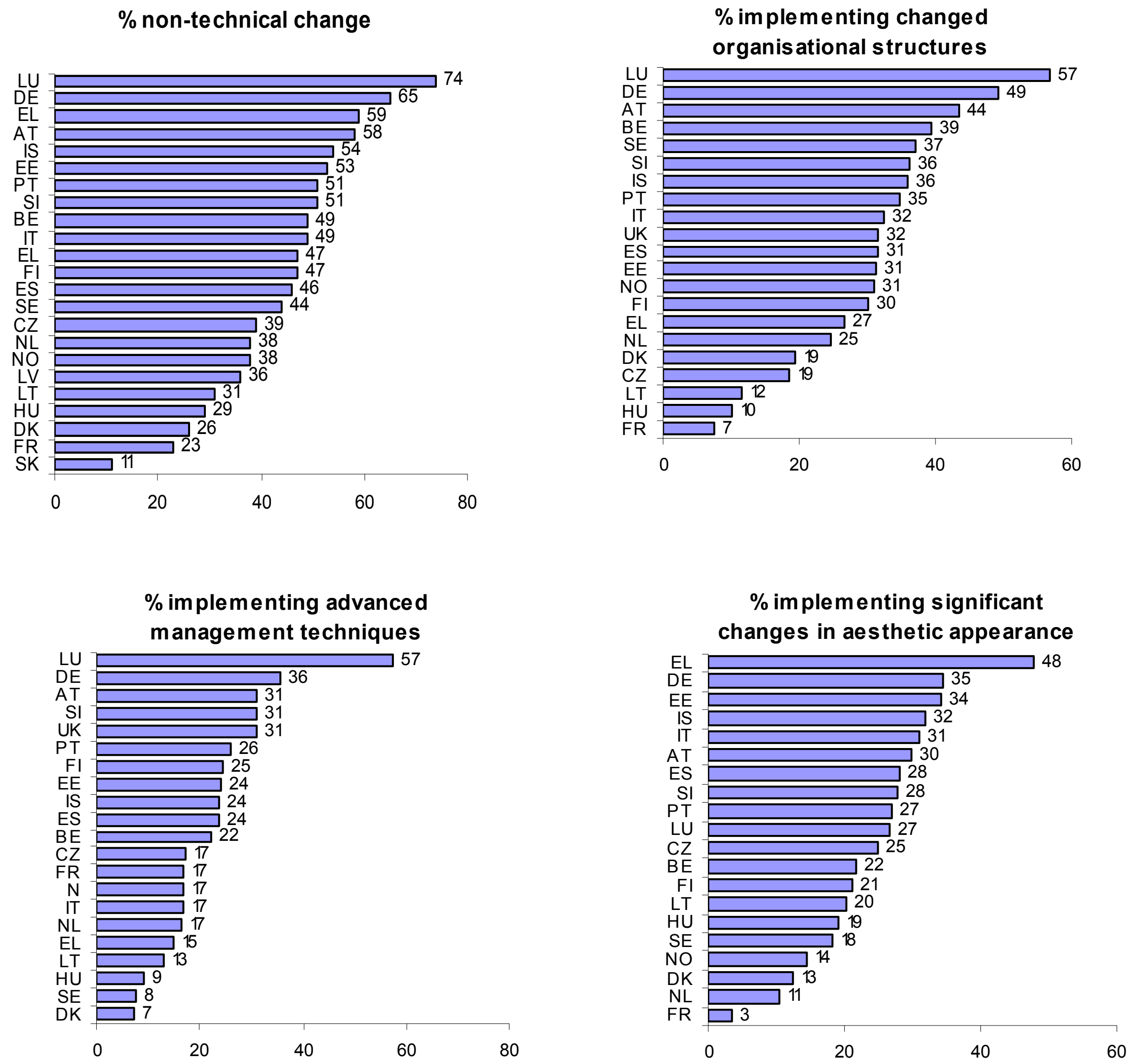
5. INNOVATION PATTERNS

The SII provides an aggregated overview of national innovation performance that does not consider the effect of structural differences in the distribution of manufacturing and service sectors or the methods that firms use to innovate. This section provides a closer look at these aspects and the way they combine into different innovation patterns.

5.1. Non-technical Innovation

Evidence from the European Competitiveness Report and other sources suggest that the advance of the US over Europe in productivity growth is not only a matter of technological innovation. US enterprises also seem to be better in reshaping their organisation and management methods in order to maximise profit from new technologies. In many cases, new business models, innovative delivery modes and integrated product and brand management are crucial elements for the transformation of technological innovation into new markets. Non-technical innovation may well be the “missing link” that prevents Europe from taking full advantage of new technological opportunities. Hence there is renewed interest in the assumption that “technological and social change must go hand in hand”.

Figure 4 Non-technical change



The 2004 EIS features, for the first time, a new indicator for non-technical change and innovation. Using data from CIS3, indicator 3.4 is a composite indicator and reflects the share of SMEs that have either implemented ‘advanced management techniques’, ‘new or significantly changed organizational structures’, or ‘significant changes in the aesthetic appearance or design of at least one product’.

Figure 4 shows this composite indicator and each of the three underlying sub-indicators for 21 countries. This indicator is the only one that is currently available on the subject but it should be interpreted with care. For some countries the results for organisational change are very high and, for most countries, the occurrence of organisational change seems to be significantly higher than the implementation rate of advanced management methods. This raises doubts about the common understanding of the underlying concepts and indicates that the results must be interpreted cautiously.

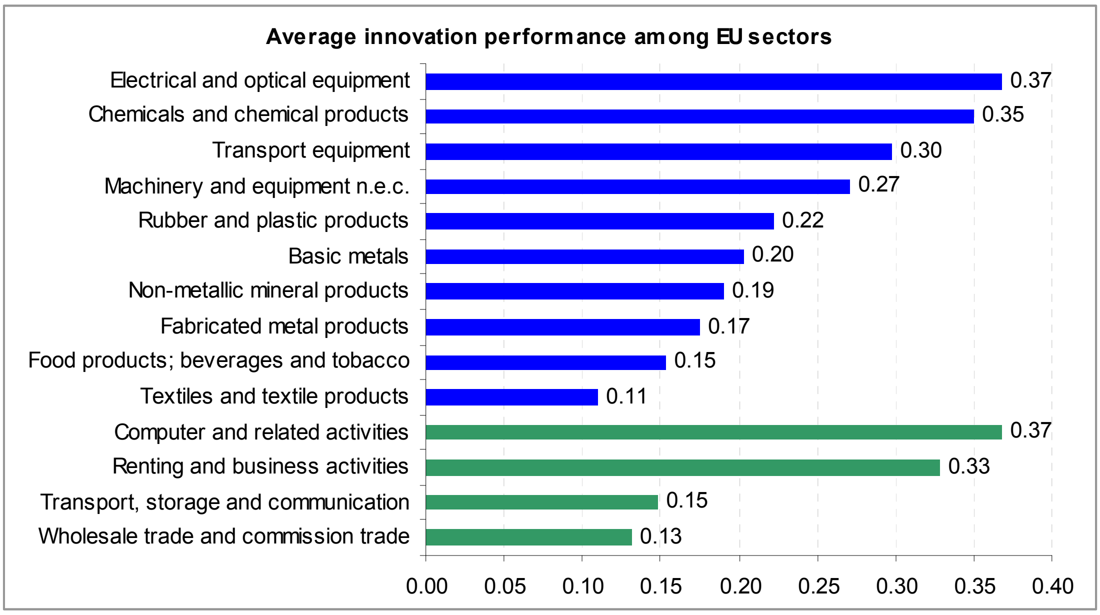
The results for non-technical change are of interest, however, because of the different pattern across countries for these indicators compared to the SII. In fact, there is virtually no correlation between the indicator for non-technical change and the SII (correlation coefficient of –0.04). Several countries that are average or poor performers on the SII, such as Luxembourg, Italy, Greece, Portugal, Estonia and Slovenia perform much better on the indicators for non-technical change. The good performance of several of the new Member States and Greece and Portugal is encouraging, since substantial changes to organisation and management, as part of a modernisation process, may provide the necessary foundation for both an increase in per capita GDP and the capacity to innovate.

The current version of the Oslo Manual, which is the theoretical basis for the CIS, does not define firms that introduce non-technological changes only as innovators and, on this basis, the latest CIS only assessed organisational *change* rather than innovation. Based on the ongoing revisions of the Oslo Manual, the next CIS should also cover organisational innovations. More reliable data on non-technical innovation will consequently be available in the future. This will allow for a better orientation of policies in this crucial area. However, due to the limitations of the statistical data currently available, non-technical innovation is not included in the following analysis of sectoral innovation patterns and types of innovators.

5.2. Dependence of innovation patterns on sectors

After the 2002 Communication concerning an "Industrial Policy in the Enlarged Europe", the European Commission launched several policy initiatives to improve the competitiveness of specific sectors, such as the textile, pharmaceutical, and aerospace industries. It is now widely recognised that the horizontal competitiveness policy laid down in the Lisbon agenda must be complemented by sector specific policies. This is particularly true in the area of innovation because the patterns and mechanisms of innovation differ widely by sector. The development of sector specific innovation policy instruments will need to be explored in the years to come.

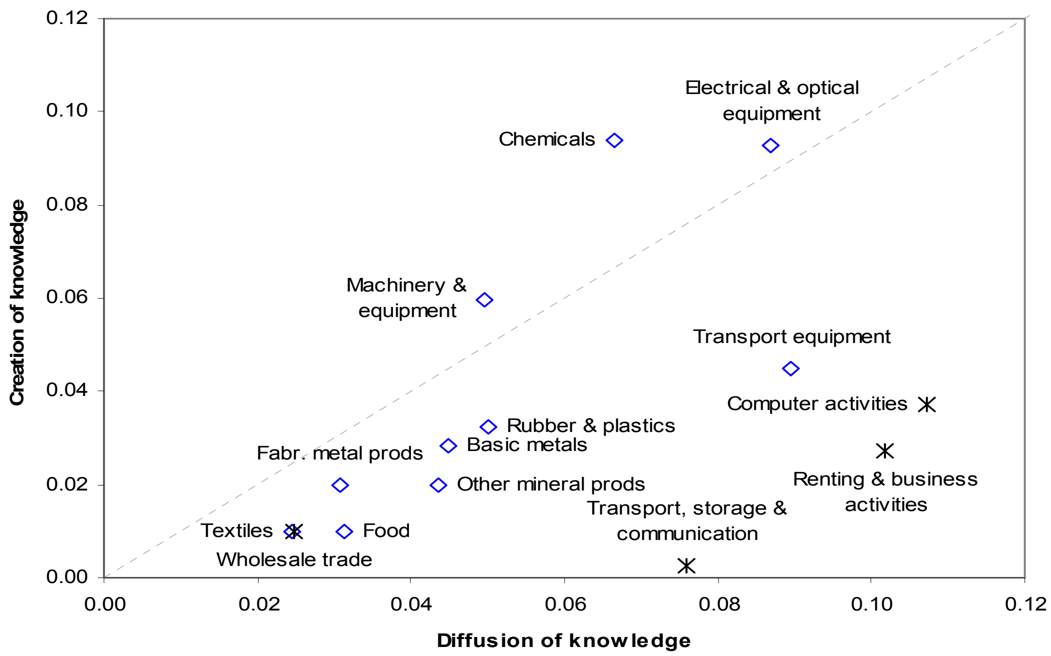
Figure 5. Innovation Sector Index (ISI)



The 2004 EIS includes, for the first time, an analysis of innovation performance by sector. Some important preliminary conclusions can be drawn from this analysis, although the database remains relatively limited at the present stage. Due to differences in data availability at the sector level, the preliminary Innovation Sector Index (ISI) uses similar but not identical indicators to those included in the SII.[14] The indicators used for the preliminary ISI are more directly linked to sectoral activity and firms in the sector.

Figure 5 shows aggregate innovation performances for 10 manufacturing and four service sectors. In all EU countries, textiles are the least innovative sector, transport equipment is a medium-high innovative sector, and electrical and optical equipment is the most innovative sector.

Figure 6. Innovation mechanisms by sectors



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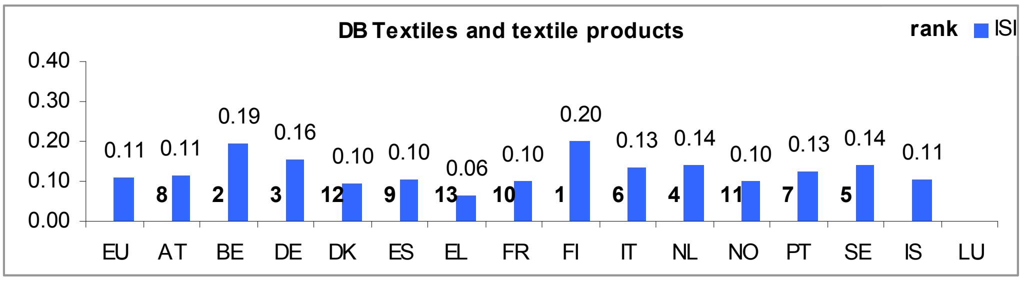
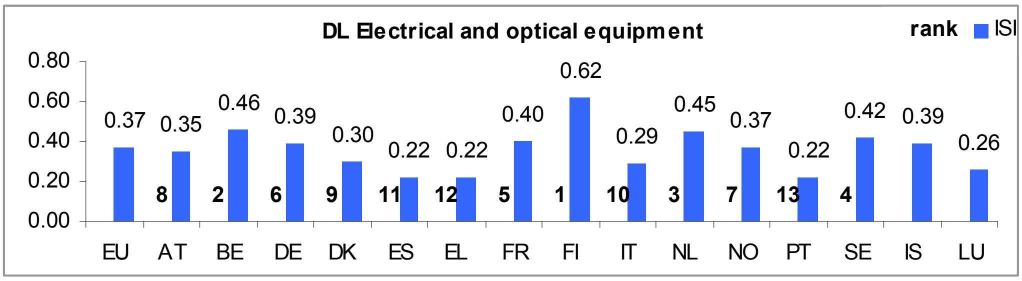
14 The following 15 indicators were used (data source in brackets): Percent of firms innovating in-house (CIS-3); percent of firms co-operating with other firms or institutes (CIS-3); innovation expenditures as a percentage of total turnover (CIS-3); share of total sector sales from new-to-market products (CIS-3); share of total sector sales from new-to-firm products (CIS-3); share of employees with higher education (CIS-3); share of firms that patent (CIS-3); share of firms that receive public subsidies to innovate (CIS-3); gross value-added per person employed (SBS); gross investment in machinery and equipment as percentage of total turnover (OECD – STAN); R&D expenditures as a percentage of value-added (OECD – STAN); growth rate of employment (OECD – STAN); export/import ratio (OECD – STAN); USPTO patents per employed person (MERIT); EPO patents per employed person (MERIT). For all sectors and indicators the data were first transformed into re-scaled values by first subtracting the minimum value for an indicator found among all EU countries among all sectors and then dividing by the difference between the maximum and minimum value for that specific indicator found among all EU countries among all sectors value. All values are thus transformed to a value between 0 and 1. The SII is then calculated by taking the average value of the re-scaled data, where all indicators are weighted equally, except for the EPO and USPTO patent indicators that are weighted at 0.5 of the other indicators (cf. Technical Paper on methodology).

Figure 6 offers more detailed insight into sector innovation patterns. Eight of the available indicators have been split into two groups: Knowledge creation and Diffusion of knowledge.[15] The analysis demonstrates that sectors rely to a varying extent on knowledge creation, on the one hand, and on the diffusion of knowledge on the other. The manufacturing sectors with the highest ISI – Electrical and optical equipment, Chemical and chemical products and Machinery and equipment - are also best at creating new knowledge. This means that the innovation performance of companies in these sectors depends, to a large extent, on excellence in knowledge creation activities. In turn, the innovation leaders for services (Computer and related activities and Renting and business activities) rely more on the diffusion of knowledge to achieve innovation excellence.

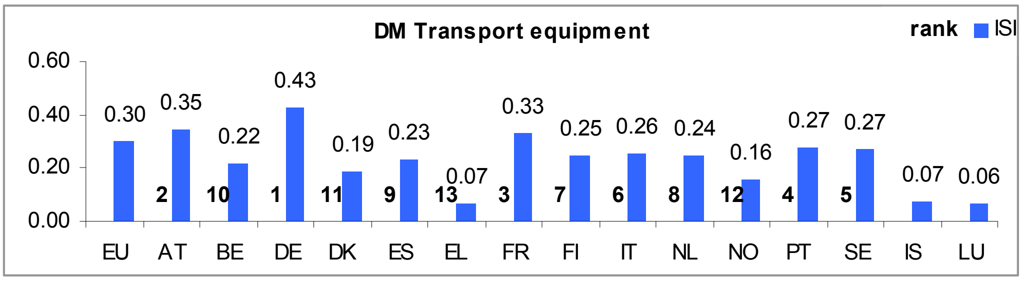
Despite certain caveats due to the availability of data (e.g. patenting data are not available for the service sectors) these findings suggest that the instruments and priorities of support policies must be adapted to the structural conditions of the sectors that are targeted. For example it is quite likely that, for certain sectors, the most efficient way to improve innovation performance is to increase R&D expenditure whilst other sectors may respond more efficiently to other instruments such as increasing non R&D innovation expenditure or innovation co-operation.

Figure7





[15] The composite indicator for Knowledge creation uses the share of firms that patent, R&D expenditures and EPO and USPTO patents per employee. The composite indicator for Diffusion of knowledge uses the share of firms co-operating, sales share of both new-to-market and new-to-firm products and gross investment in machinery and equipment.



The EIS 2004 extends the analysis of innovation in sectors for the first time to cross- country comparisons. The sector analyses show that some countries, such as Finland, tend to perform well across a large range of sectors, other countries show weak performance across many sectors with some exceptions, such as Greece, which is the innovation leader in computer services, while a third group of countries, including Austria, show a greater range in capabilities across sectors.

Figure 7 provides a preliminary insight into the distribution of strengths and weaknesses in each of 13 EU countries, Iceland and Norway for three sectors.[16]

The results in Figure 7 match several widely-held views on Europe's innovation leaders. For example, Finland leads in electrical equipment (which includes mobile telephony) and Germany leads in transport equipment. However, there are also surprises. For example, the most innovative textile sectors are in Belgium and Finland and not in Italy, Spain and Portugal, although textiles are an economically important sector in these economies. There may be different reasons for such unexpected results. For example, the internal structure of the textile sector (relative weight of sub-sectors such as weaving, knitwear, apparel manufacture, etc) may be different across countries. It may also be that in the large textile countries innovative firms are statistically hidden by the presence of a large number of traditional textile manufacturers.

The analysis of differences in national sector performances and patterns across sectors suggest that there is significant scope for further improvement and possibilities for cross-country policy learning at the sector level. In particular, a better understanding of the factors that encourage spill-overs in capabilities across sectors versus isolated areas of strength could help guide policy development.

The Commission is currently setting up a new line of action for sector specific analysis of innovation mechanisms and performances. This action will deal with sector specific innovation management techniques, good practices and benchmarks as well as panels of innovation experts in order to identify groups of innovation champions in relevant sectors. Given the statistical limitations mentioned above such a firm based approach will be necessary to complement the aggregate sector findings under the EIS.

16 For textiles and textile products the ISI for Luxembourg could not be calculated as data are only available for 3 indicators. For all sectors ranks for Iceland and Luxembourg are not gives as these countries for several sectors the ISI could not be calculated.

5.3. Types of innovating companies

There are different modes of innovation. Not all of them rely on R&D as the most important innovation driver. Firms can for example buy in critical know-how or adopt new technologies developed by other firms. Therefore a broad definition of innovation can fail to provide a clear picture of the structure of innovation capabilities of both firms and of individual sectors and countries[17].

A better understanding of the different types of innovators and the innovation modes they adopt as well as their distribution across countries and sectors would help the development of policies that can respond to actual versus idealised conditions. Further research in these issues will be launched. As a first step, a set of preliminary indicators have been developed so that innovative firms can be classified into four innovation modes, using results from the third CIS. The classification is based on two main criteria: the level of novelty of the firm's innovations, and the creative effort that the firm expends on in-house innovative activities. The four modes focus on technological product and process innovation and do not include non-technical innovation such as organizational change or the adoption of advanced management techniques[18]. Results are available for 19 of the 25 EU member states plus Iceland, Norway and Romania (data are not available for Denmark, Ireland, the UK, Cyprus, Malta, and Poland)[19].

The description of each innovation mode is as follows:

Strategic innovators (21.9% of all innovative firms): for these firms, innovation is a core component of their competitive strategy. They perform R&D on a continuous basis to develop novel product or process innovations. They are the main source of innovations that are diffused to other firms.

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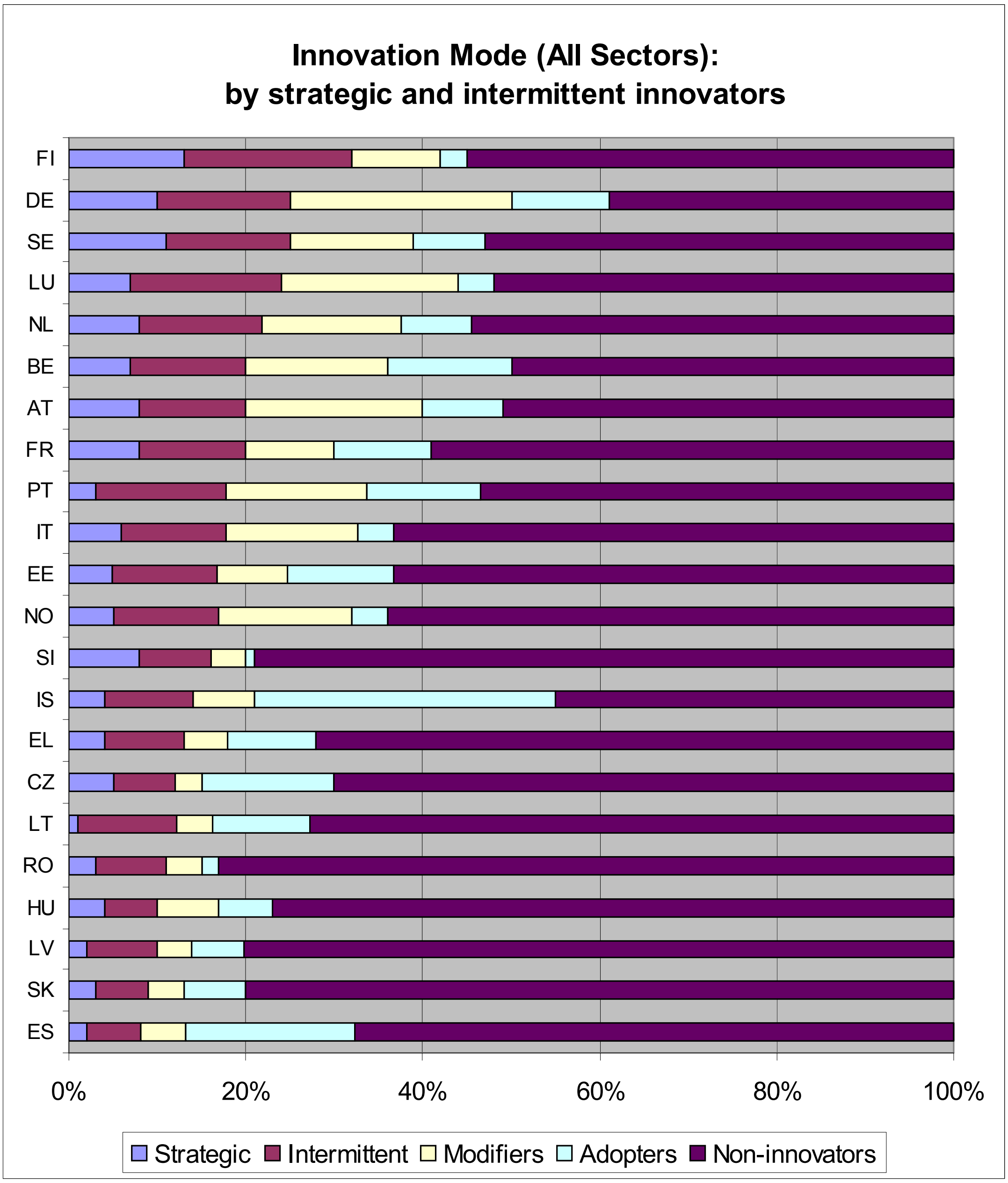
17 More detailed information is available on the Trendchart web site: www.trendchart.org

18 See the chapter on "non-technical innovation" above.

19 Full details on the methodology and results are available in the TrendChart statistical paper "The European *New Action Plan* Scoreboard".

Figure 8



Intermittent innovators (30.7% of all innovative firms): These firms perform R&D and develop innovations in-house when necessary or favourable, but innovation is not a core strategic activity. For some, their R&D efforts focus on adapting new technology developed by other firms to their own needs.

Technology modifiers (26.3% of all innovative firms): These firms modify their existing products or processes through non-R&D based activities. Many firms in this group are essentially process innovators that innovate through production engineering.

Technology adopters (21.0% of all innovative firms): These firms primarily innovate by adopting innovations developed by other firms or organizations.

Figure 9

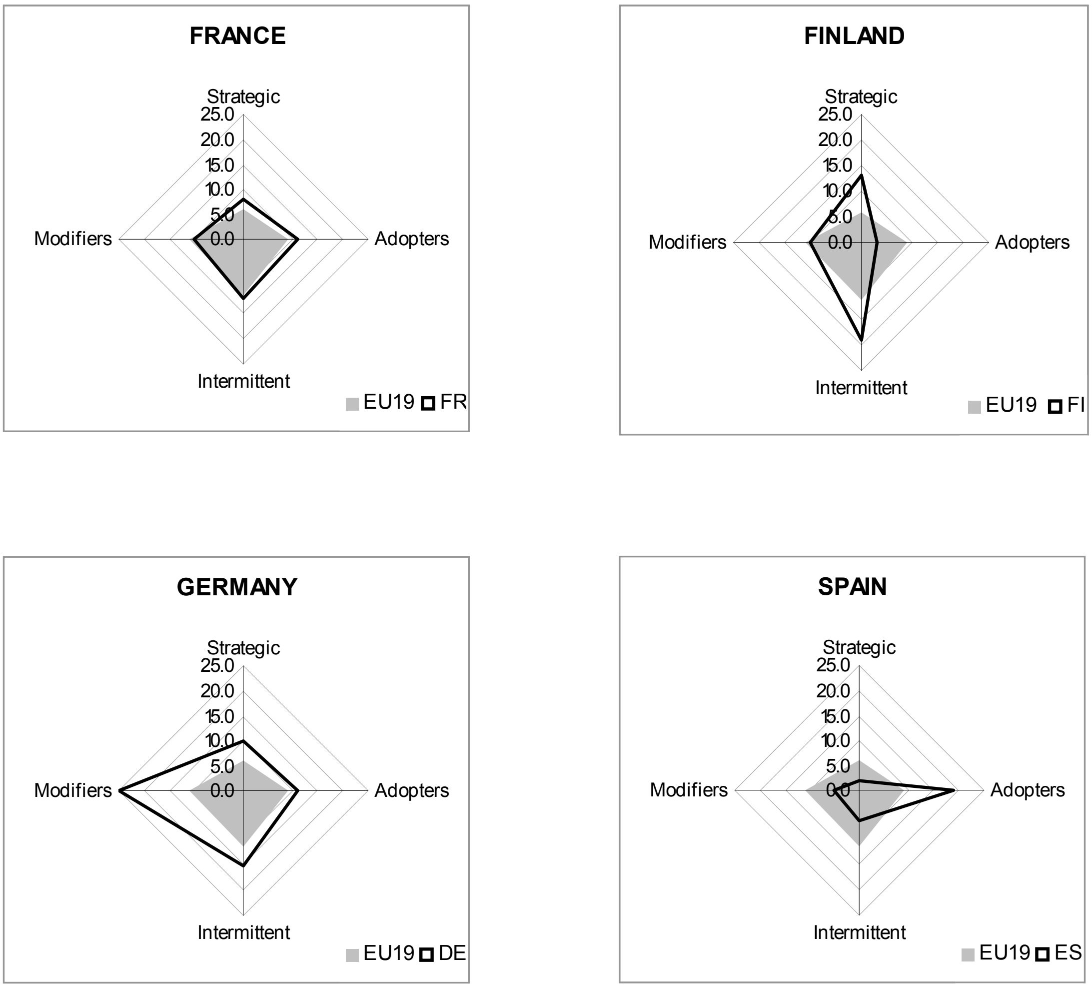


Figure 9 compares the distribution of innovation modes for four selected countries that represent very different but typical patterns of innovation. The scale is the percentage of all firms within each innovation mode. The size of the area covered by each country represents the percentage of innovators. For comparison, each figure includes the EU-19 average (the central shaded area).

Finland represents the case of a country that is squeezed on the vertical axis, with above average shares of strategic and intermittent innovators, while Spain is a typical example for countries that are squeezed on the horizontal axis, with a below average share of strategic and intermittent innovators and a high share of adopters. Germany is an example of a country with an above average share of each type of innovator, but it is particularly advantaged by a high percentage of technology modifiers. France is close to the EU average on all modes and shows roughly equivalent shares of each type.

The relevance of these findings for calibrating national innovation policies is clear despite the preliminary status of the analysis. Considerable refinement is underway, for example, an exploration as to the extent to which these national patterns are influenced by the relative weight of sectors in the national economies.

6. Overall development of EU country & US performances

In comparison with the EIS 2003, no substantial change has been observed. The trends in the US and in the EU will not enable the innovation gap to be closed fast.

Table 3 compares EU and US trends over the last years. The EU seems to further improve for indicator 1.1 for young science and engineering (S&E) graduates while the US falls further behind in this area. This increasing gap will add to the US dependence on S&E immigrants and might boost US efforts to attract talent from abroad, including from the EU. The relative EU weakness in indicator 1.2 for a highly educated workforce remains unchanged, although part of this weakness might be due to differences in statistical definitions.

Table 3. Comparison of EU and US trends (in %)

		2003 EIS		2004 EIS		
		US	EU15	US	EU15	EU25
1.1	S&E graduates as a share of 20-29 age class	-3.3	9.1	--	16.5	18.5
1.2	Working population with 3rd level education	6.1	3.3	6.8	3.4	6.6
1.3	Lifelong learning	--	0.6	--	2.8	--
1.4	Employment medium/high-tech manufacturing	--	-3.7	-8.5	-6.7	-5.4
1.5	Employment in high-tech services	--	11.5	--	2.6	0.2
2.1	Public R&D expenditures	13.4	2.0	25.2	2.0	0.5
2.2	Business R&D expenditures	2.7	4.8	-4.7	4.8	5.2
2.3.1	EPO high-tech patents	76.6	63.6	34.7	34.6	35.1
2.3.2	USPTO high-tech patents	41.9	43.9	7.9	22.5	--
2.4.1	EPO patents	30.9	25.3	14.6	14.1	14.5
2.4.2	USPTO patents	13.3	28.1	0.7	12.6	--
4.5	ICT expenditures	4.9	15.5	-3.8	-3.9	-2.9
4.6	Value-added share of high-tech manufacturing	7.0	12.0	--	--	--
	Average	10.2	9.5	3.7	5.4	5.9

The trends for the share of high-and medium-tech manufacturing in overall employment (1.4) are negative everywhere. Of note, this negative trend is strongest in the US and weakest in the EU25.

The EU continues to catch-up with the US for indicator 2.2 for business R&D expenditures (although the absolute performance gap remains large). On the other hand, the trend data point to a new and increasing gap between the EU and the US in public R&D expenditure (indicator 2.1). There are signs that the rate of increase in the enormous advance of the US in patenting trends might be halted but data are not entirely conclusive on this point. The same is true for trends in ICT expenditure (indicator 4.5). Due to the time lag in data availability, the significant downturn in both the US and in the EU continues to reflect the ICT crisis of 2001.

In most cases, trend data for the EU25 tend to be slightly better than the trend data for the EU15. This should not come as a surprise because enlargement improved EU trends for most indicators. In some cases, the trend increases are larger for the new Member States that for the EU-15, which increases the unweighted average trends The most significant exception to this concerns public R&D expenditure where the performance of the new Member States is poor (see Annex 1 Table B), possibly due to the ongoing restructuring of the public research sector in these countries.

Due to statistical problems, such as the change of indicators or the lack of data, it is difficult to correctly measure the innovation performance gap between the EU and the US over time. For example, after four years of the EIS, it could be interesting to establish time lines for aggregate performances. However, attempting to do this may raise major statistical and technical difficulties. For instance, several indicators time series are incomplete or suffer from breaks in definitions. The indicators covering the transmission and application of knowledge rely on the CIS. They are available for two years only (1996 and 2000) and suffer from serious comparability problems. Furthermore, data for the most recent years (2003 and 2002) are often not yet available. Taking into account these weaknesses an attempt has been made to offer an estimated time line of the aggregate innovation performances of EU15, US and Japan, as well as the EU25 Member States. It should be underlined that the result is an approximation where the numerous gaps and differences in definition were bridged by estimations[20].

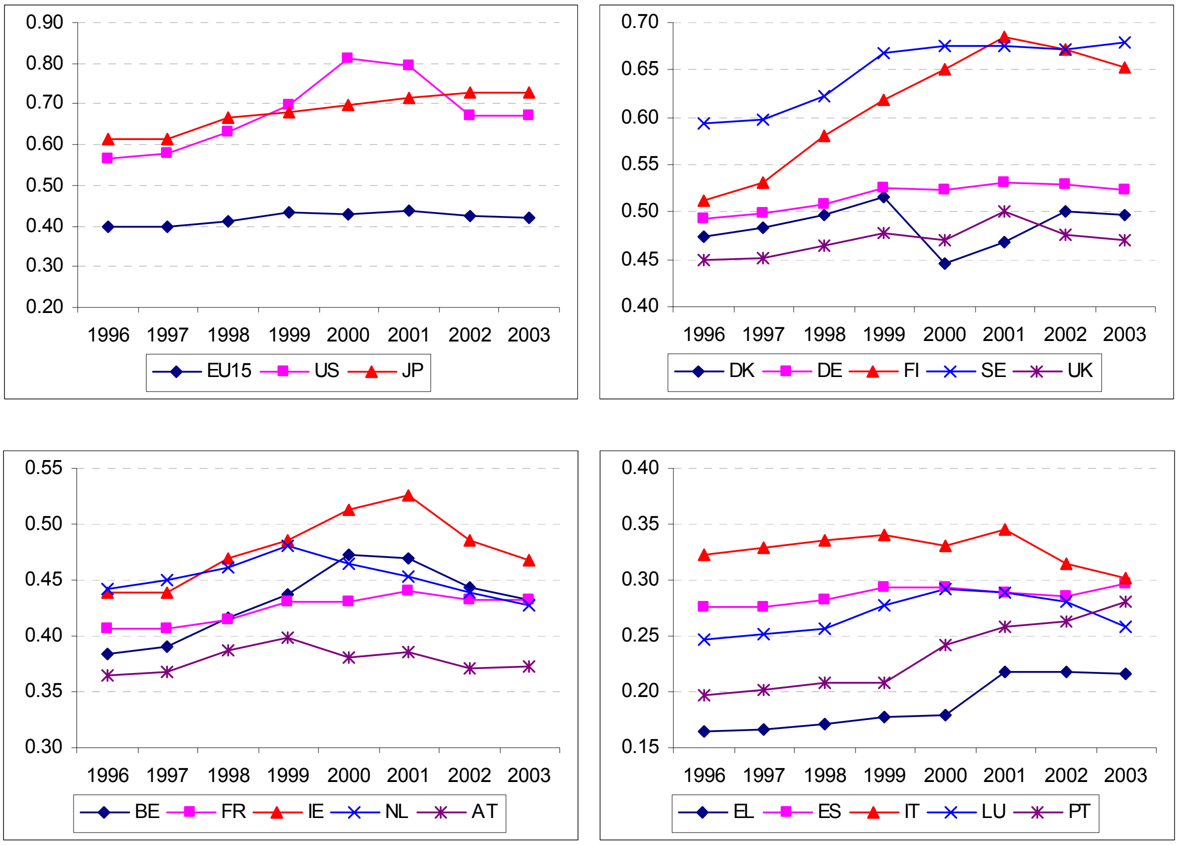
Taking into account the statistical limitations, it can be concluded that the EU innovation performance has been relatively constant since 1996, whereas the innovation performance of the US and Japan have further improved, thus widening the gap. Further analyses of the EU results show however that Member States have followed different paths.

The results are presented in Figure 10 that have been split into four graphs. Graph a) shows the aggregate performances for the US, Japan and EU 15. Japan appears to be the leader and the only entity with constant progress, while the EU stagnates and the US show a peak in aggregate innovation performance between 1999 and 2001. Graph b) shows the five Member States with the highest aggregate innovation performance. The graph confirms the exceptional growth performance of Sweden and Finland since the mid-nineties while Germany, Denmark and the UK tend to stagnate or to show a very modest growth. Graph c) suggests that Austria is stagnating, France modestly growing and that three countries (Ireland,

20 The decline of aggregate innovation performance in most countries in 2000-2001 is related to the sharp decreases in the share of early-stage venture capital in GDP in 2000 and 2001: re-scaled data for early-stage venture capital drop by almost 40% on average between 2001 and 2002. Also, due to the calculation method, the volatility of the venture capital market has a greater relative influence on the US aggregated innovation performance.

Belgium and Netherlands) show a decline after an earlier growth period. Graph d) shows Portugal, Spain and Greece on long-term growth trajectories of different shapes, while Italy and Luxembourg tend to decline.

Figure 10. Estimated aggregate innovation performances over time



The broad aggregate picture from Figure 10 is complemented by a wealth of data contained in the national data sheets included in the Annex. These data allow the tracking of specific national strengths and weaknesses for both trends and performances, in considerable detail. The drop in the “real time SII” for the US can be explained in full by indicator 4.2 only!

7. CONCLUSION

The European Innovation Scoreboard has been developed to evaluate and compare innovation performance in the European Union. It is now a well recognized instrument that must be constantly updated.

Since its inception, it has been regularly improved with a number of new analyses:

– Sectoral innovation

– Innovation modes

– Non technical innovation

This working paper analyses the innovation performance in the European Union and provides first initial insights with regard to the sectoral situation. The results of the EIS 2004 may be used in identifying the main innovation policy challenges which have to be addressed to reach the Lisbon targets.

As a follow up of this working document, the Commission services will:

– Undertake further efforts to improve the statistical analysis, by updating statistical data and methodology;

– Enter a policy dialog with the Member States, based on the open method of coordination, with a view to establishing a common framework of innovation policy objectives which reflect the main challenges as identified in the EIS 2004.

– Present the EIS 2005 together with the Trendchart country reports that analyse innovation policy developments in the Member States, in order to develop the analysis of the link between innovation performance and innovation policies. The documents will mainly focus on how Member State policies have contributed, or are expected to contribute, to the closing of the innovation gap.

ANNEX 1

Main Data Tables

Table A: European Innovation Scoreboard 2004 – Indicators and Sources

Table B: European Innovation Scoreboard 2004 – Current performance

Table C: European Innovation Scoreboard 2004 – Years used for current performance

Table D: European Innovation Scoreboard 2004 – Trend performance

Table E: European Innovation Scoreboard 2004 – Years used for trend base performance

Table F: European Innovation Scoreboard 2004 – Manufacturing and services data

Technical Annex

Definition of the indicators

Annex Table B: European Innovation Scoreboard 2004: Current performance

		EU25	EU15	BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT	NL
1.1	S&E grads	*11.5*	*12.5*	10.5	5.7	12.2	8.1	6.6	--	12.2	20.2	20.5	6.1	3.7	8.1	14.6	1.8	4.8	2.7	6.6
1.2	Work pop w 3rd educ	21.2	21.8	29.0	12.0	31.9	24.3	30.4	17.8	25.2	23.1	26.5	10.8	29.5	18.2	23.2	16.3	15.4	9.0	24.9
1.3	Lifelong learning	9.0	9.7	8.5	5.4	18.9	6.0	6.2	3.7	5.8	7.4	9.7	4.7	7.9	8.1	4.5	6.3	6.0	4.2	16.5
1.4	Emp h-tech manuf	6.60	7.10	6.42	8.71	6.12	11.04	3.35	1.99	5.15	6.50	6.28	7.42	1.24	1.85	3.03	1.36	8.27	8.16	4.06
1.5	Emp h-tech serv	3.19	3.49	3.94	3.18	4.50	3.32	2.32	1.75	2.35	4.07	3.92	2.93	2.00	2.31	1.66	2.94	3.14	3.05	3.72
2.1	Public R&D exp	*0.67*	0.69	0.57	0.47	0.77	0.77	0.55	0.43	0.47	0.83	0.35	0.55	0.26	0.25	0.54	0.13	0.66	--	0.79
2.2	Business R&D exp	*1.27*	1.30	1.64	0.75	1.75	1.73	0.22	0.21	0.56	1.36	0.80	0.55	0.06	0.17	0.14	1.58	0.36	0.08	1.03
2.3.1	EPO h-tech pats	26.0	30.9	27.7	0.5	44.9	45.5	2.6	1.4	3.5	31.8	26.8	7.1	0.7	0.5	1.3	7.5	4.0	0.8	93.0
2.3.2	USPTO h-tech pats	9.4	11.2	8.8	0.2	16.4	15.6	1.1	0.2	1.4	12.1	8.1	4.3	0.0	0.3	0.0	0.4	0.5	0.0	15.4
2.4.1	EPO pats	133.6	158.5	148.1	10.9	214.8	301.0	8.9	8.1	25.5	147.2	89.9	74.7	9.9	6.0	2.6	201.3	18.3	17.7	278.9
2.4.2	USPTO pats	59.9	71.3	70.4	3.9	83.8	137.2	2.7	1.9	8.0	68.1	32.4	30.3	2.1	0.3	0.5	96.3	4.9	2.5	86.6
3.1	SMEs innov in-hse	*31.7*	*32.1*	38.3	*24.6*	16.1	46.2	*36.9*	17.5	24.3	29.2	--	31.0	--	*15.9*	*21.5*	39.2	--	--	34.1
3.2	SMEs innov co-op	*7.1*	*6.9*	9.6	6.2	15.8	9.2	11.3	6.3	2.7	9.3	--	3.0	--	*4.0*	12.3	--	11.1	--	9.6
3.3	Innovation exp	*2.15*	*2.17*	2.65	1.07	0.54	2.72	1.43	2.08	1.24	2.53	--	1.95	--	*2.56*	1.74	1.29	1.40	--	1.50
3.4	Non-tech change	49	--	49	39	26	65	53	59	46	23	--	49	--	36	31	74	29	--	38
4.1	Hi-tech venture capital	--	50.8	40.3	27.8	69.8	63.4	--	51.5	44.7	57.4	33.5	33.7	--	--	--	--	8.0	--	34.0
4.2	Early stage VC	*0.025*	0.025	0.028	0.001	0.063	0.021	--	0.008	0.012	0.029	0.023	0.005	--	0.000	--	--	0.002	--	0.027
4.3.1	New-to-mark prods	*5.9*	*5.9*	5.1	7.2	6.6	6.2	4.5	2.9	8.3	5.7	--	9.5	--	--	4.3	2.1	1.4	--	***5.6***
4.3.2	New-to-firm prods	*16.8*	*17.1*	13.9	7.3	13.5	23.4	5.4	8.9	17.0	11.7	--	16.1	--	--	10.6	7.3	4.9	--	12.1
4.4	Internet (comp. ind.)	--	0.57	0.67	--	0.89	0.72	--	0.28	0.37	0.34	0.51	0.43	0.44	0.00	0.07	0.61	--	--	0.77
4.5	ICT exp	*6.3*	6.2	6.5	9.2	6.5	6.1	11.5	5.0	4.8	5.9	4.6	5.0	--	10.1	8.2	6.9	9.4	--	7.1
4.6	VA h-tech manuf	12.7	14.1	13.1	7.1	15.0	11.9	--	6.3	6.5	18.3	30.6	9.9	4.0	2.8	8.1	3.2	16.0	28.4	12.1

Data in *italic*: MERIT estimate; data in **bold**: national data; data underlined: OECD data.

Annex Table B (continued)

		EU25	EU15	AT	PL	PT	SI	SK	FI	SE	UK	CH	IS	NO	BG	RO	TR	US	JP
1.1	S&E grads	*11.5*	*12.5*	5.3	8.1	7.4	9.5	7.8	17.2	13.3	19.5	**7.2**	9.2	7.7	11.7	5.8	--	10.2	**13.0**
1.2	Work pop w 3rd educ	21.2	21.8	16.5	13.8	11.0	17.8	11.8	33.2	27.2	30.6	26.9	25.7	31.4	21.3	9.6	9.3	38.1	36.3
1.3	Lifelong learning	9.0	9.7	7.9	5.0	3.7	15.1	4.8	17.6	34.2	21.3	24.8	24.0	21.3	1.4	1.3	--	--	--
1.4	Emp h-tech manuf	6.60	7.10	6.21	--	3.14	8.94	8.00	6.85	7.03	6.27	7.09	2.02	4.53	4.66	5.32	--	4.65	--
1.5	Emp h-tech serv	3.19	3.49	3.32	--	1.43	2.67	2.54	4.68	4.85	4.40	4.04	4.81	3.85	2.69	1.45	--	--	--
2.1	Public R&D exp	*0.67*	0.69	0.65	0.46	0.61	0.62	0.26	1.04	0.95	0.61	0.67	1.32	0.71	0.40	0.15	0.43	0.86	0.80
2.2	Business R&D exp	*1.27*	1.30	1.13	0.13	0.32	0.91	0.31	2.37	3.32	1.26	1.90	1.77	0.96	0.09	0.23	0.21	1.90	2.32
2.3.1	EPO h-tech pats	26.0	30.9	23.6	0.3	0.8	3.4	0.9	120.2	74.7	32.0	56.9	42.6	23.0	0.6	0.2	0.0	48.4	40.4
2.3.2	USPTO h-tech pats	9.4	11.2	6.5	0.0	0.1	1.5	0.0	51.4	38.1	14.0	18.3	21.5	6.3	0.1	0.0	0.0	76.4	75.4
2.4.1	EPO pats	133.6	158.5	174.8	2.7	4.3	32.8	4.3	310.9	311.5	128.7	460.1	121.8	131.3	3.7	0.9	1.0	154.5	166.7
2.4.2	USPTO pats	59.9	71.3	65.4	0.4	1.3	8.4	1.9	158.6	187.4	64.5	188.3	58.0	55.1	0.8	0.2	0.2	301.4	273.9
3.1	SMEs innov in-hse	*31.7*	*32.1*	35.5	***12.5***	36.2	*18.3*	*12.5*	37.6	35.2	*22.4*	***54.8***	46.5	28.8	--	--	--	--	--
3.2	SMEs innov co-op	*7.1*	*6.9*	8.8	***5.0***	7.0	7.6	*3.3*	20.0	13.4	*7.7*	***10.4***	12.5	12.5	--	2.9	--	--	--
3.3	Innovation exp	*2.15*	*2.17*	--	***1.84***	2.62	1.28	*8.09*	2.50	--	*1.83*	***3.48***	1.70	1.22	--	1.32	--	--	--
3.4	Non-tech change	49	--	58	--	51	51	10	47	44	--	--	54	38	--	77	--	--	--
4.1	Hi-tech venture capital	--	50.8	34.9	6.6	50.5	--	50.0	49.0	48.1	45.7	32.4	35.8	32.8	--	--	--	--	--
4.2	Early stage VC	*0.025*	0.025	0.013	0.007	0.026	--	0.002	0.065	0.081	0.038	0.039	0.048	0.032	--	0.003	--	0.072	--
4.3.1	New-to-mark prods	*5.9*	*5.9*	4.6	--	10.8	5.3	*6.6*	14.5	--	*1.9*	--	1.7	1.2	--	7.8	--	--	--
4.3.2	New-to-firm prods	*16.8*	*17.1*	13.2	--	15.1	4.9	*6.2*	17.5	--	*15.1*	***20.5***	3.2	7.2	--	1.6	--	--	--
4.4	Internet (comp. ind.)	--	0.57	0.53	0.27	0.27	0.45	--	0.69	1.00	0.69	--	1.08	0.73	--	--	--	--	1.02
4.5	ICT exp	*6.3*	6.2	6.1	7.7	6.3	6.8	8.9	6.6	8.2	7.5	--	--	5.6	11.2	6.4	3.2	6.3	6.1
4.6	VA h-tech manuf	12.7	14.1	11.5	5.7	6.5	13.3	5.2	24.9	15.9	18.8	**34.0**	--	10.3	8.6	5.2	6.6	23.0	18.7

Data in *italic*: MERIT estimate; data in **bold**: national data; data underlined: OECD data.

Annex Table C: European Innovation Scoreboard 2004 – Years used for current performance

		EU25	EU15	BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT	NL
1.1	S&E grads	2002	2002	2002	2002	2001	2002	2002	--	2002	2001	2002	2001	2001	2002	2002	2000	2002	2001	2002
1.2	Work pop w 3rd educ	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2002
1.3	Lifelong learning	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
1.4	Emp h-tech manuf	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2002
1.5	Emp h-tech serv	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2002
2.1	Public R&D exp	2002	2002	2001	2002	2002	2003	2003	2001	2002	2003	2001	2001	2002	2002	2003	2000	2002	--	2001
2.2	Business R&D exp	2002	2002	2002	2002	2002	2003	2003	2001	2002	2003	2001	2003	2002	2002	2003	2000	2002	2003	2002
2.3.1	EPO h-tech pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2001	2002	2002	2002	2002	2002
2.3.2	USPTO h-tech pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
2.4.1	EPO pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
2.4.2	USPTO pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
3.1	SMEs innov in-hse	2000	2000	2000	2001	2000	2000	2000	2000	2000	2000	--	2000	--	2001	2001	2000	--	--	2000
3.2	SMEs innov co-op	2000	2000	2000	2001	2000	2000	2000	2000	2000	2000	--	2000	--	2001	2001	--	2000	--	2000
3.3	Innovation exp	2000	2000	2000	2001	2000	2000	2000	2000	2000	2000	--	2000	--	2001	2001	2000	2000	--	2000
3.4	Non-tech change	2000	--	2000	2001	2000	2000	2000	2000	2000	2000	--	2000	--	2001	2001	2000	2000	--	2000
4.1	Hi-tech venture capital	--	02/03	02/03	02/03	02/03	02/03	--	01/02	02/03	02/03	02/03	02/03	--	--	--	--	02/03	--	02/03
4.2	Early stage VC	02/03	02/03	02/03	02/03	02/03	02/03	--	02/03	02/03	02/03	02/03	02/03	--	00/01	--	--	02/03	--	02/03
4.3.1	New-to-mark prods	2000	2000	2000	2001	2000	2000	2000	2000	2000	2000	--	2000	--	--	2001	2000	2000	--	2000
4.3.2	New-to-firm prods	2000	2000	2000	2001	2000	2000	2000	2000	2000	2000	--	2000	--	--	2001	2000	2000	--	2000
4.4	Internet	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4.5	ICT exp	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	--	2003	2003	2002	2003	--	2003
4.6	VA h-tech manuf	2001	2001	2001	2001	2001	2001	--	2001	2001	2001	2001	2001	2001	2000	2001	2001	2001	2001	2001

Annex Table C (continued)

		EU25	EU15	AT	PL	PT	SI	SK	FI	SE	UK	CH	IS	NO	BG	RO	TR	US	JP
1.1	S&E grads	2002	2002	2002	2002	2002	2002	2002	2001	2002	2002	2002	2002	2002	2002	2002	--	2000	2001
1.2	Work pop w 3rd educ	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2002	2003	2003	2003	2002	2002	2002
1.3	Lifelong learning	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	--	--	--
1.4	Emp h-tech manuf	2003	2003	2003	--	2003	2003	2003	2003	2003	2003	2003	2002	2003	2003	2003	--	2001	--
1.5	Emp h-tech serv	2003	2003	2003	--	2003	2003	2003	2003	2003	2003	2003	2002	2003	2003	2003	--	--	--
2.1	Public R&D exp	2002	2002	1998	2002	2002	2002	2003	2003	2001	2002	2000	2002	2002	2002	2002	2000	2003	2002
2.2	Business R&D exp	2002	2002	1998	2002	2002	2002	2003	2003	2001	2002	2000	2002	2002	2002	2002	2000	2003	2002
2.3.1	EPO h-tech pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
2.3.2	USPTO h-tech pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
2.4.1	EPO pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
2.4.2	USPTO pats	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
3.1	SMEs innov in-hse	2000	2000	2000	2000	2000	2000	2001	2000	2000	2000	2002	2000	2000	--	--	--	--	--
3.2	SMEs innov co-op	2000	2000	2000	2000	2000	2000	2001	2000	2000	2000	2002	2000	2000	--	2000	--	--	--
3.3	Innovation exp	2000	2000	--	2000	2000	2000	2001	2000	--	2000	2002	2000	2000	--	2000	--	--	--
3.4	Non-tech change	2000	--	2000	--	2000	2000	2001	2000	2000	--	--	2000	2000	--	2000	--	--	--
4.1	Hi-tech venture capital	--	02/03	02/03	02/03	02/03	--	02/03	02/03	02/03	02/03	02/03	01/02	02/03	--	--	--	--	--
4.2	Early stage VC	02/03	02/03	02/03	02/03	02/03	--	02/03	02/03	02/03	02/03	02/03	01/02	02/03	--	02/03	--	01/02	--
4.3.1	New-to-mark prods	2000	2000	2000	--	2000	2000	2001	2000	--	2000	--	2000	2000	--	2000	--	--	--
4.3.2	New-to-firm prods	2000	2000	2000	--	2000	2000	2001	2000	--	2000	2002	2000	2000	--	2000	--	--	--
4.4	Internet	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4.5	ICT exp	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	--	--	2003	2003	2003	2003	2003	2003
4.6	VA h-tech manuf	2001	2001	2001	2000	2001	2001	2001	2001	2001	2001	2001	--	2001	2001	2001	2000	2000	2000

Annex Table D: European Innovation Scoreboard 2004 – Trend performance

		EU25	EU15	BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT	NL
1.1	S&E grads	18.5	16.5	8.2	13.2	49.7	-5.1	-5.7	--	33.6	10.2	-10.1	18.1	-2.6	23.4	27.0	28.6	-1.4	107.7	12.5
1.2	Work pop w 3rd educ	6.6	3.4	8.3	4.4	17.8	3.9	3.4	4.9	12.3	6.7	20.7	10.7	17.9	1.2	3.8	-10.5	8.4	--	8.8
1.3	Lifelong learning	2.8	2.8	21.4	--	-10.6	13.2	5.1	5.4	15.2	1.9	--	-12.4	--	--	--	22.7	8.3	--	8.8
1.4	Emp h-tech manuf	-5.4	-6.7	-6.8	-3.0	-7.4	-0.4	-23.1	-10.2	-5.5	-9.8	-12.6	-1.8	13.8	7.6	-4.7	-18.7	-1.8	--	-8.8
1.5	Emp h-tech serv	0.2	2.6	8.4	2.0	-6.8	10.2	-22.0	8.2	-0.7	3.8	-3.1	1.3	20.7	5.5	-17.4	-5.3	3.7	--	-9.9
2.1	Public R&D exp	0.5	2.0	4.3	6.0	2.2	3.1	10.7	0.0	10.2	2.0	0.0	2.5	30.0	-16.7	13.3	--	54.7	--	-12.2
2.2	Business R&D exp	5.2	4.8	16.3	1.4	25.9	-0.2	17.9	31.3	17.5	-1.7	-10.4	3.1	38.5	54.5	20.0	--	21.3	--	-6.4
2.3.1	EPO h-tech pats	35.1	34.6	30.1	-10.7	47.3	32.2	77.3	133.0	35.7	29.4	67.3	20.2	-18.8	78.5	--	--	97.0	--	69.1
2.3.2	USPTO h-tech pats	--	22.5	0.7	--	3.8	36.8	--	13.9	42.9	12.1	123.1	23.1	--	--	--	--	--	--	2.2
2.4.1	EPO pats	14.5	14.1	4.7	1.2	30.2	12.8	42.1	15.5	17.5	11.2	24.4	11.3	22.6	54.2	--	--	30.3	23.8	32.6
2.4.2	USPTO pats	--	12.6	5.6	6.0	5.7	17.5	1.1	24.8	14.4	5.8	29.1	8.1	63.8	-67.7	--	--	24.9	-3.5	5.9
4.5	ICT exp	-2.9	-3.9	-4.4	4.0	-5.1	-3.9	-7.3	-11.5	-10.3	-0.8	-14.8	-2.9	--	4.7	24.2	-5.5	-2.1	--	-4.1
4.6	VA h-tech manuf	--	12.0	16.0	--	12.1	17.6	--	0.1	-6.1	11.1	0.3	9.7	--	--	--	6.5	--	--	8.9
	Country average	5.9	5.4	8.2	3.5	10.0	6.3	1.0	8.3	9.4	3.8	3.4	4.4	20.0	12.4	9.5	2.6	14.8	--	2.5

For EU25 country average, EU15 trend data for indicators 2.3.2, 2.4.2 and 4.6 have been used as proxies for EU25 trend data.

		EU25	EU15	AT	PL	PT	SI	SK	FI	SE	UK	CH	IS	NO	BG	RO	TR	US	JP
1.1	S&E grads	18.5	16.5	-27.7	41.3	19.4	12.6	59.2	4.2	36.6	24.5	40.7	27.2	2.2	88.7	35.9	--	-3.3	3.8
1.2	Work pop w 3rd educ	6.6	3.4	15.3	21.9	23.3	16.0	13.3	3.8	-2.6	8.5	10.3	12.6	-0.9	8.1	3.6	15.4	6.8	14.2
1.3	Lifelong learning	2.8	2.8	-7.4	4.2	9.9	--	--	-4.5	--	3.1	8.6	7.1	--	--	39.3	--	--	--
1.4	Emp h-tech manuf	-5.4	-6.7	-6.2	--	-12.8	3.9	18.6	-6.2	-8.9	-14.9	-9.1	20.7	1.3	-15.3	1.5	--	-8.5	--
1.5	Emp h-tech serv	0.2	2.6	17.3	--	11.7	8.1	-12.7	7.6	-6.4	-0.8	4.6	17.3	-4.1	-0.7	3.8	--	--	--
2.1	Public R&D exp	0.5	2.0	--	12.2	5.2	-4.1	14.7	3.7	7.1	-1.6	-16.3	4.8	-2.7	-9.1	40.6	29.0	25.2	-7.0
2.2	Business R&D exp	5.2	4.8	--	-51.9	88.2	18.2	-26.8	1.1	22.1	3.6	-1.6	55.3	4.3	-20.6	-26.6	43.2	-4.7	10.1
2.3.1	EPO h-tech pats	35.1	34.6	62.0	50.0	65.7	143.0	--	14.3	10.6	48.2	29.5	7.4	66.7	56.3	73.7	-26.8	34.7	31.4
2.3.2	USPTO h-tech pats	--	22.5	31.1	--	28.6	--	--	36.1	22.2	19.3	20.3	75.4	37.4	--	--	--	7.9	7.7
2.4.1	EPO pats	14.5	14.1	20.8	36.6	46.6	68.6	--	15.0	6.6	17.6	6.3	16.6	14.7	-8.4	-10.1	17.8	14.6	28.1
2.4.2	USPTO pats	--	12.6	18.4	-10.7	34.7	24.7	--	25.0	20.8	8.2	5.8	60.1	14.0	128.1	63.6	128.0	0.7	8.8
4.5	ICT exp	-2.9	-3.9	-2.4	13.2	-4.5	-5.6	14.1	-2.9	-4.1	0.0	--	--	5.7	25.1	-21.0	-65.8	-3.8	13.0
4.6	VA h-tech manuf	--	12.0	1.8	--	6.7	--	--	19.1	-10.6	12.5	5.8	--	59.7	--	--	30.6	7.0	12.0
	Country average	5.9	5.4	3.0	8.9	19.1	14.0	11.5	4.8	5.4	5.8	6.5	23.1	11.0	15.5	12.5	14.3	4.1	9.3

For EU25 country average, EU15 trend data for indicators 2.3.2, 2.4.2 and 4.6 have been used as proxies for EU25 trend data.

Annex Table E: European Innovation Scoreboard 2004 – Years used for trend base performance

		EU25	EU15	BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT	NL
1.1	S&E grads	1997-99	1997-99	--	1998-00	1998-99	1998-00	--	--	1998-00	1997-99	1998,00	1997-99	1999	1998-00	1998-00	1998	1998-00	1999	1998-00
1.2	Work pop w 3rd educ	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	--	1999-01	1999-01	--	1998-00
1.3	Lifelong learning	--	--	1999-01	--	--	1999-01	1999-01	--	1999-01	--	--	1999-01	--	--	--	1999-01	--	--	1999-01
1.4	Emp h-tech manuf	2000-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	--	--	1999-01	1999-01	--	--
1.5	Emp h-tech serv	2000-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	--	--	1999-01	1999-01	--	--
2.1	Public R&D exp	1998-00	1998-00	1997-99	1998-00	1998-00	1999-01	1999-01	1997,99	1998-00	1999-01	1997-99	1997-99	1998-00	1998-00	1999-01	--	1998-00	--	1997-99
2.2	Business R&D exp	1998-00	1998-00	1998-00	1998-00	1998-00	1999-01	1999-01	1997,99	1998-00	1999-01	1997-99	1999-01	1998-00	1998-00	1999-01	--	1998-00	--	1998-00
2.3.1	EPO h-tech pats	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998,00	1997,99	--	--	1998-00	--	1998-00
2.3.2	USPTO h-tech pats	--	1998-00	1998-00	--	1998-00	1998-00	--	--	1998-00	1998-00	1998-00	1998-00	--	--	--	--	1998-00	--	1998-00
2.4.1	EPO pats	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	--	--	1998-00	1998-00	1998-00
2.4.2	USPTO pats	--	1998-00	1998-00	1998-00	1998-00	1998-00	1999,00	1998-00	1998-00	1998-00	1998-00	1998-00	1998,00	1998-00	1998,99	1998-00	1998-00	1998,00	1998-00
4.5	ICT exp	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	--	2000-01	2000-01	2000	2000-01	--	2000-01
4.6	VA h-tech manuf	--	1997-99	1997-99	--	1997-99	1997-99	--	1997-99	1997-99	1997-99	1997-99	1997-99	--	--	--	1997-99	--	--	1997-99

		EU25	EU15	AT	PL	PT	SI	SK	FI	SE	UK		CH	IS	NO	BG	RO	TR	US	JP
1.1	S&E grads	1997-99	1997-99	1998-00	1998-00	--	1998-00	1998-00	1997-99	1998-00	1998-00		1998-00	1998-00	1998-00	1998-00	1998-00	--	1996,98	1998-99
1.2	Work pop w 3rd educ	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01	1999-01		1999-01	1999-00	1999-01	2000-01	1999-01	1998-00	1998-00	1998-00
1.3	Lifelong learning	--	--	1999-01	2001	1999-01	--	--	--	--	1999-01		--	1999-01	--	2001	1999-01	--	--	--
1.4	Emp h-tech manuf	2000-01	1999-01	1999-01	--	1999-01	1999-01	1999-01	1999-01	--	1999-01		1999-01	1998-00	1999-01	--	1999-01	--	1997-99	--
1.5	Emp h-tech serv	2000-01	1999-01	1999-01	--	1999-01	1999-01	1999-01	1999-01	--	1999-01		1999-01	1998-00	1999-01	--	1999-01	--	--	--
2.1	Public R&D exp	1998-00	1998-00	--	1998-00	1999	1998-00	1999-01	1999-01	1997-99	1998-00		1996	1998-00	1999	1998-00	1998-00	1996-98	1999-01	1998-00
2.2	Business R&D exp	1998-00	1998-00	--	1998-00	1999	1998-00	1999-01	1999-01	1997-99	1998-00		1996	1998-00	1999	1998-00	1998-00	1996-98	1999-01	1998-00
2.3.1	EPO h-tech pats	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	--	1998-00	1998-00	1998-00		1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00
2.3.2	USPTO h-tech pats	--	1998-00	1998-00	--	--	--	--	1998-00	1998-00	1998-00		1998-00	1998-00	1998-00	--	--	--	1998-00	1998-00
2.4.1	EPO pats	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	--	1998-00	1998-00	1998-00		1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00
2.4.2	USPTO pats	--	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00		1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00	1998-00
4.5	ICT exp	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01		--	--	2000-01	2000-01	2000-01	2000-01	2000-01	2000-01
4.6	VA h-tech manuf	--	1997-99	1997-99	--	1997-99	--	--	1997-99	1997-99	1997-99		1997-99	--	1998-99	--	--	1996-98	1996-98	1996-98

Annex Table F: European Innovation Scoreboard 2004 – Manufacturing and services data

		EU25	EU15	BE	CZ	DK	DE	EE	EL	ES	FR	IE	IT	CY	LV	LT	LU	HU	MT	NL
Manufacturing																				
3.1	SMEs innov in-hse	--	35.0	46.2	25.8	16.7	52.4	39.1	16.8	29.1	33.5	--	34.9	--	19.1	26.0	38.8	--	15.4	42.5
3.2	SMEs innov co-op	7.0	6.7	11.7	6.5	18.9	9.4	11.8	4.9	3.2	12.3	--	2.8	--	4.1	11.6	--	14.3	4.9	11.1
3.3	Innovation exp	3.48	3.52	4.92	1.49	0.95	5.03	2.39	2.22	1.87	3.18	--	2.96	--	3.65	2.29	2.08	2.57	--	3.09
3.4	Non-tech change	50	--	53	39	24	67	56	--	46	24	--	51	--	37	31	58	34	--	40
4.3.1	New-to-mark prods	7.8	7.8	6.0	10.8	11.4	7.5	6.2	1.8	8.3	7.2	--	12.4	--	--	5.5	3.3	2.7	37.8	7.9
4.3.2	New-to-firm prods	20.9	21.2	13.8	10.7	19.4	36.9	10.1	7.6	17.9	12.9	--	19.9	--	--	20.7	12.6	10.1	--	19.7
Services																				
3.1	SMEs innov in-hse	--	28.4	31.8	22.7	15.4	42.6	33.5	21.3	16.6	23.9	--	20.0	--	11.2	14.9	39.6	--	--	28.1
3.2	SMEs innov co-op	7.2	7.2	7.7	5.8	12.7	9.3	11.6	12.4	1.9	5.4	--	3.5	--	3.8	12.1	--	6.1	--	8.5
3.3	Innovation exp	1.08	1.09	0.92	0.72	0.36	1.06	0.78	1.60	0.65	1.57	--	0.84	--	1.66	1.10	1.18	0.25	--	0.79
3.4	Non-tech change	49	--	47	39	29	63	50	--	47	22	--	44	--	35	31	78	22	--	37
4.3.1	New-to-mark prods	4.4	4.3	4.5	4.6	4.5	5.2	4.1	6.5	8.8	3.5	--	6.8	--	--	4.0	2.0	0.7	--	3.3
4.3.2	New-to-firm prods	14.5	14.8	14.3	4.7	11.0	13.1	3.3	13.6	17.0	10.9	--	12.1	--	--	3.1	6.7	1.1	--	8.9

		EU25	EU15	AT	PL	PT	SI	SK	FI	SE	UK	CH	IS	NO	BG	RO	TR	US	JP
Manufacturing																			
3.1	SMEs innov in-hse	--	35.0	35.5	12.3	35.5	22.0	14.1	40.9	35.5	24.8	58.0	44.8	32.3	--	--	24.6	--	--
3.2	SMEs innov co-op	7.0	6.7	7.4	3.8	6.1	9.8	4.4	22.0	14.1	8.1	13.0	11.1	12.6	--	2.5	18.0	--	--
3.3	Innovation exp	3.48	3.52	--	2.32	2.86	1.74	8.80	3.91	--	2.58	4.29	0.85	2.06	--	1.62	--	--	--
3.4	Non-tech change	50	--	57	--	46	55	--	45	43	--	--	53	38	--	79	--	--	--
4.3.1	New-to-mark prods	7.8	7.8	7.5	3.3	11.4	7.7	10.3	23.9	--	2.2	--	1.0	3.1	--	10.9	9.4	--	--
4.3.2	New-to-firm prods	20.9	21.2	20.5	15.8	15.5	6.6	9.3	27.3	--	6.8	20.7	4.9	12.5	--	2.4	--	--	--
Services																			
3.1	SMEs innov in-hse	--	28.4	36.4	12.8	37.6	12.7	10.0	34.9	35.6	18.7	50.1	48.4	26.3	--	--	--	--	--
3.2	SMEs innov co-op	7.2	7.2	10.1	6.8	9.2	5.2	1.6	18.3	12.8	7.0	6.5	--	12.1	--	3.7	--	--	--
3.3	Innovation exp	1.08	1.09	--	1.44	2.66	0.66	7.50	0.96	--	1.22	2.81	2.29	1.03	--	1.11	--	--	--
3.4	Non-tech change	49	--	58	--	62	47	--	49	45	--	--	56	37	--	75	--	--	--
4.3.1	New-to-mark prods	4.4	4.3	2.7	--	7.3	2.2	2.9	4.5	--	1.6	--	0.8	1.7	--	5.4	--	--	--
4.3.2	New-to-firm prods	14.5	14.8	7.9	--	12.3	2.5	3.6	7.0	--	22.0	20.4	2.4	6.1	--	1.3	--	--	--

Technical Annex

A.1 Calculating averages

For those indicators for which EU means were not available from Eurostat, these have been estimated by combining numerator and denominator data for as many EU countries as possible. This procedure differs from that used in the 2003 EIS, where for S&E graduates a weighted average was calculated using shares of population 20-29 years of age and for all CIS-indicators weighted averages were calculated using GDP shares. In particular the EU15 means for the CIS-indicators are not necessarily equal to those in the 2003 EIS.

A.2 Calculating trend data

Trends are calculated as the percentage change between the last year for which data are available and the average over the preceding three years, after a one-year lag. The three-year average is used to reduce year-to-year variability; the one-year lag is used to increase the difference between the average for the three base years and the final year and to minimize the problem of statistical/sampling variability. For example, when the most recent data are for 2002, the trend is based on the percentage change between 2002 and the average for 1998 to 2000 inclusive. The results for 2001 are excluded in order to provide a one-year lag. There are several exceptions to this rule due to a lack of adequate data. Technical Paper No X provides the specific years used to calculate the trends for each indicator per country. For all patent indicators, the average of the last two years has been used to calculate trends.

The aggregate trend per country is calculated as a weighted average of the trend values of the various indicators. The following weights were used for calculating average country and EU trends:

- 1 for indicators 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 4.6 and 4.7.
- 0.25 for indicators 2.3.1, 2.3.2, 2.4.1 and 2.4.2.

The Methodology report provides a more detailed explanation.

A.3 Summary Innovation Index

The SII is calculated using re-scaled values of the indicator data, where the highest value within the group of EU25 countries is set to 1 and the lowest value within the group of EU25 countries to 0. The SII is then calculated as the average value of all re-scaled values and is by definition between 0 and 1 for the EU25 countries. The following weights were used for calculating the averages SII scores:

- 1 for indicators 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 3.3, 3.4 4.1, 4.2, 4.3.1, 4.3.2, 4.4, 4.5 and 4.6.
- 0.5 for indicators 2.3.1, 2.3.2, 2.4.1, 2.4.2.

The Methodology report provides a more detailed explanation.

A.4 Manufacturing and services innovation index

The manufacturing innovation index includes the following indicators: 1.4 and the manufacturing sub-indicators of 3.1, 3.2, 3.3, 3.4, 4.3.1 and 4.3.2.

The services innovation index includes the following indicators: 1.5 and the services sub-indicators of 3.1, 3.2, 3.3, 3.4, 4.3.1 and 4.3.2.

2004 EUROPEAN INNOVATION SCOREBOARD: DEFINITIONS

1. HUMAN RESOURCES

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

Definition

Numerator: S&E (science and engineering) graduates 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).

Denominator: The reference population is all age classes between 20 and 29 years inclusive.

Source: EUROSTAT: NewCronos/Population and social conditions/Education and Training/Education/Education indicators/Tertiary education graduates

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

Definition

Numerator: Number of persons in age class with some form of post-secondary education (ISCED 5 and 6).

Denominator: The reference population is all age classes between 25 and 64 years inclusive.

Source: EUROSTAT: NewCronos/Population and social conditions/Labour market/Employment and unemployment/Employment/Total employment – LFS series/ Employment by sex, age groups and highest level of education attained (1000)

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

Definition

Numerator: Life-long learning is defined as participation in any type of education or training course during the four weeks prior to the survey. Education includes both courses of relevance to the respondent's employment and general interest courses, such as in languages or arts. It includes initial education, further education, continuing or further training, training within the company, apprenticeship, on-the-job training, seminars, distance learning, and evening classes.

Denominator: The reference population is all age classes between 25 and 64 years inclusive.

Source: EUROSTAT: NewCronos/Population and social conditions/Labour market/Employment and unemployment/Main indicators/Structural indicators/Employment/Life-long learning: total

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

Definition

Numerator: Number of employed persons in the medium-high and high-technology manufacturing sectors. These include chemicals (NACE 24), machinery (NACE 29), office equipment (NACE 30), electrical equipment (NACE 31), telecommunications and related equipment (NACE 32), precision instruments (NACE 33), automobiles (NACE 34), and aerospace and other transport (NACE 35).

Denominator: The total workforce includes all manufacturing and service sectors.

Source: EUROSTAT: NewCronos/Population and social conditions/Labour market/Employment and unemployment/Employment/Total employment – LFS series/ Employment by sex, age groups and economic activity (1000)

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

Definition

Numerator: Number of employed persons in the high-technology services sectors. These include post and telecommunications (NACE 64), information technology including software development (NACE 72), and R&D services (NACE 73).

Denominator: The total workforce includes all manufacturing and service sectors.

Source: EUROSTAT: NewCronos/Population and social conditions/Labour market/Employment and unemployment/Employment/Total employment – LFS series/ Employment by sex, age groups and economic activity (1000)

2 KNOWLEDGE CREATION

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

Definition

Numerator: Difference between GERD (Gross domestic expenditure on R&D) and BERD (Business enterprise expenditure on R&D). Both GERD and BERD according to Frascati-manual definitions, in national currency and current prices. Note that this definition is a proxy of public R&D expenditures as it also includes the R&D expenditures from the Private Non Profit (PNP) sector.

Denominator: Gross domestic product as defined in the European System of Accounts (ESA 1995), in national currency and current prices.

Source: EUROSTAT: NewCronos/Science and Technology/Research and development/Statistics on research and development/R&D expenditure/National R&D expenditure/ Total intramural R&D expenditure (GERD) by sectors of performance. OECD: Main Science and Technology Indicators.

2.2 Business expenditures on R&D (BERD) (% of GDP)

Definition

Numerator: All R&D expenditures of the business sector (manufacturing and services), according to Frascati-manual definitions, in national currency and current prices.

Denominator: Gross domestic product as defined in the European System of Accounts (ESA 1995), in national currency and current prices.

Source: EUROSTAT: NewCronos/Science and Technology/Research and development/Statistics on research and development/R&D expenditure/National R&D expenditure/ Total intramural R&D expenditure (GERD) by sectors of performance. OECD: Main Science and Technology Indicators.

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

Definition

Numerator: Number of patents applied for at the European Patent Office (EPO), by year of filing. The national (and regional) distribution of the patent applications is assigned according to the address of the inventor. The high technology patent classes include: 1) Computer and Automated Business Equipment: B41J, G06, G11C; 2) Micro-organism, genetic engineering: C12M, C12N, C12P, C12Q; 3) Aviation: B64; 4) Communications: H04; 5) Semiconductors: H01L; 6) Laser: H01S (See Annex A for a full list of IPC subclasses).

Denominator: Total population as defined in the European System of Accounts (ESA 1995).

Source: EUROSTAT. NewCronos/Science and technology/European and US patenting systems/ Patent applications to EPO by date of filing/Patent applications to the EPO at the national level/ High tech patent applications to the EPO by year of filing at the national level by high tech group; total number, per million inhabitants and per million labour force

2.3.2 USPTO high-tech patent granted (per million population)

Definition

Numerator: Number of patents applied for at the US Patent and Trademark Office (USPTO), by year of grant. The high technology patent classes include: 1) Computer and Automated Business Equipment: B41J, G06, G11C; 2) Micro-organism, genetic engineering: C12M, C12N, C12P, C12Q; 3) Aviation: B64; 4) Communications: H04; 5) Semiconductors: H01L; 6) Laser: H01S (See Annex A for a full list of IPC subclasses).

Denominator: Total population as defined in the European System of Accounts (ESA 1995).

Source: USPTO. USPTO patent data are, according to US patent law, for patents granted. High-tech patent data are, by exception, for patent *applications,* following the objectives of the Trilateral Corporation (established in 1983 by the European Patent Office (EPO), the Japanese Patent Office (JPO) and the U.S. Patent and Trademark Office (USPTO)). NewCronos/Science and technology/European and US patenting systems/ Patents granted by the USPTO by grant date/ High tech patents granted by the USPTO by grant date and high tech group

2.4.1 EPO patent applications (per million population)

Definition

Numerator: Number of patents applied for at the European Patent Office (EPO), by year of filing. The national distribution of the patent applications is assigned according to the address of the inventor.

Denominator: Total population as defined in the European System of Accounts (ESA 1995).

Source: EUROSTAT: NewCronos/Science and technology/European and US patenting systems/ Patent applications to EPO by date of filing/Patent applications to the EPO at the national level/ Patent applications to the EPO by year of filing at the national level by IPC; total number, per million inhabitants and per million labour force

2.4.2 USPTO patents granted (per million population)

Definition

Numerator: Number of patents granted by the US Patent and Trademark Office (USPTO), by year of grant. Patents are allocated to the country of the inventor, using fractional counting in the case of multiple inventor countries.

Denominator: Total population as defined in the European System of Accounts (ESA 1995).

Source: EUROSTAT: NewCronos/Science and technology/European and US patenting systems/ Patents granted by the USPTO by grant date/ Patents granted by the USPTO by grant date

3 TRANSMISSION AND APPLICATION OF KNOWLEDGE

Whereas the 2003 EIS included separate indicators for manufacturing and services, indicators 3.1, 3.2, 3.3, 4.3.1 and 4.3.2 cover the following NACE classes: mining and quarrying (NACE 10-14), manufacturing (NACE 15-37), electricity, gas and water supply (NACE 40-41), wholesale trade (NACE 51), transport, storage and communication (NACE 60-64), financial intermediation (NACE 65-67), computer and related activities (NACE 72), research and development (NACE 73), architectural and engineering activities (NACE 74.2) and technical testing and analysis (NACE 74.3).

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

Definition

Numerator: Sum of all SMEs with in-house innovation activities. Innovative firms are defined as those who introduced new products or processes either 1) in-house or 2) in combination with other firms. This indicator does not include new products or processes developed by other firms.

Denominator: Total number of SMEs.

Source: EUROSTAT: NewCronos/Science and technology/ Survey on innovation in EU enterprises/ Results of the third community innovation survey (CIS3)/ The European Innovation scoreboard indicators

3.2 SMEs involved in innovation co-operation (% of all SMEs)

Definition

Numerator: Sum of SMEs with innovation co-operation activities. Firms with co-operation activities are those that had any co-operation agreements on innovation activities with other enterprises or institutions in the three years of the survey period.

Denominator: Total number of SMEs.

Source: EUROSTAT: NewCronos/Science and technology/ Survey on innovation in EU enterprises/ Results of the third community innovation survey (CIS3)/ The European Innovation scoreboard indicators

3.3 Innovation expenditures (% of all turnover)

Definition

Numerator: Sum of total innovation expenditure for enterprises. 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.

Denominator: Total turnover for all enterprises. This includes firms that do not innovate, whose innovation expenditures are zero by definition.

Source: EUROSTAT: NewCronos/Science and technology/ Survey on innovation in EU enterprises/ Results of the third community innovation survey (CIS3)/ The European Innovation scoreboard indicators

3.4 Share of SMEs that use non-technical change (% of all SMEs)

Definition

Numerator: CIS question 12.1 asks firms if, between 1998 and 2000, they implemented ‘advanced management techniques’, ‘new or significantly changed organizational structures’, or ‘significant changes in the aesthetic appearance or design in at least one product ’. A ‘yes’ response to at least one of these categories would identify a SME using non-technical change.

Denominator: Total number of SMEs.

Source: EUROSTAT: CIS-3.

4 INNOVATION FINANCE, OUTPUT AND MARKETS

Whereas the 2003 EIS included separate indicators for manufacturing and services, indicators 3.1, 3.2, 3.3, 4.3.1 and 4.3.2 cover the following NACE classes: mining and quarrying (NACE 10-14), manufacturing (NACE 15-37), electricity, gas and water supply (NACE 40-41), wholesale trade (NACE 51), transport, storage and communication (NACE 60-64), financial intermediation (NACE 65-67), computer and related activities (NACE 72), research and development (NACE 73), architectural and engineering activities (NACE 74.2) and technical testing and analysis (NACE 74.3).

4.1 Share of high-tech venture capital investment

Definition

Numerator: High-tech venture capital includes the following sectors: computer related fields, electronics, biotechnology, medical/health, industrial automation, and financial services.

Denominator: Venture capital is defined as the sum of early stage capital (seed and start-up) plus expansion capital.

Venture capital investments show strong year-to-year fluctuations. In order to reduce these fluctuations, two-year averages have been used: the 2001 high-tech venture capital share is thus equal to the average of the 2000 and 2001 shares.

Source: EVCA's (European Private Equity & Venture Capital Association) "Mid-Year Survey of Pan-European Private Equity & Venture Activity".

4.2 Share of early stage venture capital in GDP

Definition

Numerator: Venture capital investment is defined as private equity raised for investment in companies. Management buyouts, management buyins, and venture purchase of quoted shares are excluded. Early-stage capital includes seed and start-up capital. *Seed* is defined as financing provided to research, assess and develop an initial concept before a business has reached the start-up phase. *Start-up* is defined as financing provided for product development and initial marketing, manufacturing, and sales. Companies may be in the process of being set up or may have been in business for a short time, but have not yet sold their product commercially.

Denominator: Gross domestic product as defined in the European System of Accounts (ESA 1995), in national currency and current prices.

Venture capital investments show strong year-to-year fluctuations. In order to reduce these fluctuations, two-year averages have been used: the 2002 early-stage venture capital share is thus equal to the average of the 2001 and 2002 shares.

Source: EUROSTAT: NewCronos/ Key indicators on EU policy (predefined tables)/ Structural indicators/Innovation and research/ Venture capital investments: early stage.

4.3.1 Sales of 'new to market' products (% of all turnover)

Definition

Numerator: Sum of total turnover of new or significantly improved products for all enterprises.

Denominator: Total turnover for all enterprises.

Source: EUROSTAT: NewCronos/Science and technology/ Survey on innovation in EU enterprises/ Results of the third community innovation survey (CIS3)/ The European Innovation scoreboard indicators

4.3.2 Sales of 'new to the firm but not new to the market' products (% of all turnover)

Definition

Numerator: Sum of total turnover of new or significantly improved products to the firm but not to the market for all enterprises.

Denominator: Total turnover for all enterprises.

Source: EUROSTAT: NewCronos/Science and technology/ Survey on innovation in EU enterprises/ Results of the third community innovation survey (CIS3)/ The European Innovation scoreboard indicators

4.4 INTERNET ACCESS/USE

Definition

This is a composite indicator using the average of the re-scaled values for the following two indicators:

Level of Internet access by households (% of all households)

Numerator: Number of households who have Internet access at home. All forms of use are included. Population considered is equal to or over 15 years old.

Denominator: The number of households.

Source: EUROSTAT: NewCronos/ Key indicators on EU policy (predefined tables)/ Structural indicators/Innovation and research/ Level of Internet access: households

Level of Internet access by: enterprises (% of all enterprises)

Numerator: Number of enterprises that have access to the Internet (web). Only enterprises with more than 9 persons employed are included. NACE sections D, G, H, I, K covered.

Denominator: Total number enterprises.

Source: EUROSTAT: NewCronos/ Key indicators on EU policy (predefined tables)/ Structural indicators/Innovation and research/ Level of Internet access: enterprises

4.5 ICT expenditures (% of GDP)

Definition

Numerator: Total expenditures on information and communication technology (ICT). ICT includes office machines, data processing equipment, data communication equipment, and telecommunications equipment, plus related software and telecom services.

Denominator: Gross domestic product as defined in the European System of Accounts (ESA 1995), in national currency and current prices.

Source: NewCronos/ Key indicators on EU policy (predefined tables)/ Structural indicators/Innovation and research/ ICT expenditure: IT expenditure; NewCronos/ Key indicators on EU policy (predefined tables)/ Structural indicators/Innovation and research/ ICT expenditure: Telecommunications expenditure

4.6 SHARE OF MANUFACTURING VALUE-ADDED IN HIGH-TECH SECTORS

Definition

Numerator: Total value added in manufacturing in five high technology industries: pharmaceuticals (NACE 24.4), office equipment (NACE 30), telecommunications and related equipment (NACE 32), instruments (NACE 33) and aerospace (NACE 35.3).

Denominator: Value added of total manufacturing sector, in national currency and current prices.

Source: EUROSTAT: NewCronos/ Industry, trade and services/ Industry and construction/ Annual detailed enterprise statistics on industry and construction/ Annual detailed enterprise statistics on manufacturing subsections DF-DN (incl. coke, chemicals, plastics, minerals, metals, machinery and transport equipment) and total manufacturing (NACE D) (part of Annex 2).