



## **Rethinking the European Innovation Scoreboard: A revised methodology for 2008-2010**

**Output paper from the workshop on  
"Improving the European Innovation Scoreboard methodology"  
Brussels, 16 June 2008 (<http://www.eis.eu/workshop>)**

This paper presents the results of the discussions, comments and papers of the workshop on the Innovation Dimensions and Innovation Indicators to be used in future versions of the European Innovation Scoreboard.

A full methodology report including the approach for a composite indicator, assessing changes over time and making international comparisons will be made available in Autumn 2008.

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### Disclaimer:

The views expressed in this report, as well as the information included in it, do not necessarily reflect the opinion or position of the European Commission and in no way commit the institution.

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## Table of content

1. Introduction.....	2
2. Innovation dimensions .....	3
3. Innovation indicators .....	6
2.1 Enablers .....	6
2.1.1 Human resources .....	6
2.1.2 Finance and support .....	9
3.2 Firm activities .....	11
3.2.1 Firm investments .....	11
3.2.2 Linkages & entrepreneurship .....	14
3.2.3 Throughputs.....	16
3.3 Outputs .....	18
3.3.1 Innovators .....	18
3.3.2 Economic performance.....	19
4. Conclusions and further recommendations .....	22
References .....	23
Annex 1: EIS 2007 Indicators .....	24

## 1. Introduction

The European Innovation Scoreboard (EIS) is the instrument developed at the initiative of the European Commission, under the Lisbon Strategy, to provide a comparative assessment of the innovation performance of EU Member States. The EIS provides an annual assessment of innovation performance across the EU and other leading innovative nations. The assessment is based on a wide range of indicators covering structural conditions, knowledge creation, innovation by firms, and outputs in terms of new products, services and intellectual property.

Since its introduction in 2000, the EIS has been both welcomed as a relevant tool for innovation benchmarking but it has only been criticized, repeatedly, for not capturing all relevant dimensions of the innovation process, for using improper indicators, for not taking into account structural differences between countries, and for using composite indicators to summarize innovation performance in one number.

This report is a follow-up of the Input paper for the workshop on "Improving the European Innovation Scoreboard methodology" held in Brussels, 16 June 2008<sup>2</sup>. The Input paper discussed the main challenges of the EIS and discussed proposals for a revised set of innovation dimensions and indicators. The main aim of this "Output" paper is to present and discuss the dimensions and indicators to be used in the European Innovation Scoreboard for the period 2008-2010 that were chosen taking into account the discussions at the workshop and the written comments received after the workshop.

This Output paper will be followed by a final methodology report in the Autumn covering both the before-mentioned Input paper and this Output paper plus sections explaining the calculation of the Summary Innovation Index and other composite indicators, changes over time, new graphical presentations of EIS results and a section discussing an adapted EIS for international comparisons with non-EU countries.

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<sup>2</sup> The input paper and other workshop papers are available at the workshop's website: <http://www.eis.eu/workshop>

The remainder of this report is structured as follows. Section 2 will present the new grouping of indicators into different innovation dimensions. Section 3 will discuss the new set of indicators to be included in the EIS 2008-2010. Section 4 will conclude and will also discuss other recommendations from the workshop.

## 2. Innovation dimensions

One of the main criticisms over the years has been that the EIS lacks an underlying model of the innovation process. The main purpose of such a model would be to explain the innovation process, its inputs, throughputs and outputs, and how these are related. But explaining the innovation process is not the purpose (nor the aim) of the EIS and indeed studies show that there is a diversity of innovation processes that occur in different companies, sectors and countries. The aim of the EIS is to measure innovation performance at the country level, and for measuring such performance we do not need a detailed model fully explaining the innovation process (at the firm level). Sufficient is a more general understanding of the factors which play a role in the innovation process and how they might be related. What will be presented in this section is a simple graphical model, showing the different dimensions blocks of the innovation process. The indicators measuring such dimensions will be discussed in detail in the next section.

The EIS 2005-2007 used 5 innovation dimensions, of which 3 reflect innovation inputs (Innovation drivers, Knowledge creation and Innovation & entrepreneurship) and 2 innovation outputs (Applications and Intellectual property) (cf. Annex 1). Several aspects of the innovation process are not covered by these 5 dimensions, in particular broader non-technological or non-R&D innovation, socio-economic conditions and the financing of innovation activities. The current dimensions can also be restructured following a rather simple innovation model where innovation can result from R&D activities but also non-R&D activities.

For the EIS 2008-2010, following a better understanding of the innovation process and lessons learned from previous revisions of the EIS, the number of dimensions will be increased to 7 which will be grouped in 3 main blocks of dimensions. The purpose of this revision is to have dimensions that group together a set of related indicators in order to give a balanced assessment of the innovation performance in that dimension. The blocks and dimensions have been designed to accommodate the diversity of different innovation processes and models that occur in different national contexts.

The three blocks of dimensions comprise Enablers, Firm activities and Outputs:

- **ENABLERS** captures the main drivers of innovation that are external to the firm and is divided into the following 2 dimensions:
  - **Human resources** – the availability of high-skilled and educated people – are one of the most important innovation drivers.
  - **Finance and support** – the availability of finance for innovation projects and the support of governments for innovation activities are also important drivers of innovation.
- **FIRM ACTIVITIES** captures innovation efforts that firms undertake recognising the fundamental importance of firms' activities in the innovation process. This is captured in the following 3 dimensions:
  - **Firm investments** – This dimension covers the range of different investments firms make in order to generate innovations. It includes

investments needed to generate new products or processes – i.e. technological innovation – as well as for introducing “softer” innovations as marketing and organisational innovations – i.e. non-technological innovation -. Such investments can be done by performing R&D but also by using already existing knowledge, e.g. by buying more efficient machinery and equipment.

- **Linkages & entrepreneurship** – This dimension captures the entrepreneurial efforts and the related collaboration efforts among innovating firms but also the public sector.
  - **Throughputs** – This dimension captures the Intellectual Property Rights (IPRs) generated as a throughput in the innovation process including IPRs relevant for both technological and non-technological innovation.
- **OUTPUTS** captures, on the basis of available indicators, the outputs of firm activities and is divided in the following 2 dimensions:
    - **Innovators** – This dimension captures the success of innovation by the number of firms that have introduced innovations onto the market or within their organisations. It covers both technological and non-technological innovations.
    - **Economic effects** – This dimension captures the economic success of innovation in employment, exports and sales due to innovation activities.

It is considered that these dimensions form the core of national innovation performance. In addition there are wider socio-economic factors that influence innovation, such as the role of governments, markets, social factors and the demand and acceptance of innovation<sup>3</sup>. These factors and their relationship with innovation performance have been explored in previous EIS thematic papers<sup>4</sup> and will also be the subject of future thematic papers.

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<sup>3</sup> Indicators capturing these other factors will be included in the EIS as a second set of indicators following the discussions of the June 16 workshop. The indicators included in this second set will be presented in the final methodology report which will become available Autumn 2008.

<sup>4</sup> Most recently the EIS thematic paper on *Differences in socio-economic conditions and regulatory environment: explaining variations in national innovation performance and policy implications*. [http://www.proinno-europe.eu/admin/uploaded\\_documents/eis\\_2007\\_Socio-economic\\_conditions.pdf](http://www.proinno-europe.eu/admin/uploaded_documents/eis_2007_Socio-economic_conditions.pdf)

**TABLE 1: INDICATORS FOR THE EIS 2008-2010**

	Cf. to EIS 2007	Data source
<b>ENABLERS</b>		
• <b>Human resources</b>		
• 1.1.1 S&E and SSH graduates	Revised	Eurostat
• 1.1.2 Tertiary education	Same	Eurostat
• 1.1.3 Life-long learning	Same	Eurostat
• 1.1.4 Youth education	Same	Eurostat
• <b>Finance and support</b>		
• 1.2.1 Public R&D expenditures	Same	Eurostat
• 1.2.2 Venture capital	Revised	EVCA/ Eurostat
• 1.2.3 Private credit	New	IMF
• 1.2.4 Broadband access by firms	Revised	Eurostat
<b>FIRM ACTIVITIES</b>		
• <b>Firm investments</b>		
• 2.1.1 Business R&D expenditures	Same	Eurostat
• 2.1.2 IT expenditures	Revised	EITO/Eurostat
• 2.1.3 Non-R&D innovation expenditures	Revised	Eurostat (CIS)
• <b>Linkages &amp; entrepreneurship</b>		
• 2.2.1 SMEs innovating in-house	Same	Eurostat (CIS)
• 2.2.2 Innovative SMEs collaborating with others	Same	Eurostat (CIS)
• 2.2.3 Firm renewal (SMEs entries + exits)	New	Eurostat
• 2.2.4 ( <i>Public-private co-</i> ) Publications <sup>5</sup>	New	Thomson/ ISI
• <b>Throughputs</b>		
• 2.3.1 EPO patents	Same	Eurostat
• 2.3.2 Community trademarks	Same	OHIM
• 2.3.3 Community designs	Same	OHIM
<b>OUTPUTS</b>		
• <b>Innovators</b>		
• 3.1.1 Technological (product/service/process) innovators	New	Eurostat (CIS)
• 3.1.2 Non-technological (marketing/organisational) innovators	Revised	Eurostat (CIS)
• 3.1.3 Resource efficiency innovators <ul style="list-style-type: none"> <li>◦ 3.1.3a Reduced labour costs</li> <li>◦ 3.1.3b Reduced use of materials and energy</li> </ul>	New	Eurostat (CIS)
• <b>Economic effects</b>		
• 3.2.1 Employment in medium-high & high-tech manufacturing	Same	Eurostat
• 3.2.2 Employment in knowledge-intensive services	Revised	Eurostat
• 3.2.3 High-tech exports	Same	Eurostat
• 3.2.4 Knowledge-intensive services exports	New	Eurostat
• 3.2.5 New-market sales	Same	Eurostat (CIS)
• 3.2.6 New-to-firm sales	Same	Eurostat (CIS)
• 3.2.7 Technology Balance of Payments	New	World Bank

<sup>5</sup> The inclusion of this indicator is pending on the availability of publicly available data.

### 3. Innovation indicators

The 2007 EIS included 25 indicators (see Annex 1). In this section we will discuss for each of the new proposed dimensions which indicators will be included in order to provide a better assessment of performance in each dimension. The selection of which indicators to include follows the principles of simplicity, transparency and continuity set out in Section 1 of the Input paper. In addition the choice of indicators is intended to provide a balance between different forms of innovation (e.g. technological and non-technological innovation) and different sectors (e.g. manufacturing and services).

#### 3.1 Enablers

Enablers capture innovation drivers external to the firm, including the supply of highly skilled human resources and availability of innovation finance and public support for innovation.

##### 3.1.1 Human resources

This dimension captures the availability of high-skilled and educated people as key input for innovation. It would correspond closely to the EIS 2007 "innovation drivers" dimension. Human Resources were considered a key condition for innovation according by the various workshop participants. The following indicators will be included:

- **1.1.1 S&E and SSH graduates per 1000 population aged 20-29**
  - Numerator: Number of S&E (science and engineering) and SSH (social sciences and humanities) graduates. S&E 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). SSH graduates are defined as all post-secondary education graduates (ISCED classes 5a and above) in arts (ISC21), humanities (ISC22), social and behavioural science (ISC 31), journalism and information (ISC32), business and administration (ISC34), and law (ISC38).
  - Denominator: The reference population is all age classes between 20 and 29 years inclusive.
  - Rationale: The indicator is a measure of the supply of new graduates with training in Science & Engineering (S&E) and Social Sciences & Humanities (SSH). 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 and in the service sector. The indicator is extended as compared to the EIS 2007 with SSH graduates as these are considered as relevant for services (activities) following a recommendation from one of the workshop participants. By broadening the definition of Human Resources in innovation, it is possible to establish links not only with technological innovation but also with non-technological innovation, thus better capturing services innovation.
  - Workshop recommendations: the suggestion to enlarge this indicator to include SSH graduates has been accepted. It was also suggested to differentiate between degree and non-degree levels. However, this would create some overlap with other indicators of human resources.

- Data source: Eurostat
- **1.1.2 Population with tertiary education per 100 population aged 25-64**
  - 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.
  - Rationale: 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, in particular 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 difficult due to large discrepancies in educational systems, access, and the level of attainment that is required to receive a tertiary degree. Differences among countries should be interpreted with caution.
  - Workshop recommendations: it was suggested to differentiate between degree and non-degree levels (see comment above for S&E and SSH graduates). It was also recommended to use the population aged 25-34 as the dominator creating a more dynamic indicator and better capturing recent educational activities. However this would assume that tertiary education is more important in younger people<sup>6</sup>.
  - Data source: Eurostat
- **1.1.3 Participation in life-long learning per 100 population aged 25-64**
  - Numerator: Number of persons involved in life-long learning. Life-long learning is defined as participation in any type of education or training course during the four weeks prior to the survey. The information collected relates to all education or training whether or not relevant to the respondent's current or possible future job. It 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. It includes also courses followed for general interest and may cover all forms of education and training as language, data processing, management, art/culture, and health/medicine courses.
  - Denominator: The reference population is all age classes between 25 and 64 years inclusive.
  - Rationale: A central characteristic of a knowledge economy is continual technical development and innovation. 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 and economic benefits.
  - Workshop recommendations: A concern was raised about the timing of the survey as life-long learning is assessed by "participation in any type of education or training course during the four weeks prior to the survey". "Life-long learning courses are very seasonal, i.e. most are done during the autumn and winter months rather than spring and summer months. If the survey is completed during the latter two periods, no true reflection will be

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<sup>6</sup> For analyses over time one could consider using the 25-34 year age bracket to capture improvement in educational qualifications following changes in educational policies.

obtained.” However, from 27 October 2006, the indicator is based on annual averages of quarterly data instead of one unique reference quarter in spring<sup>7</sup>. This will improve the accuracy and reliability of the indicator thanks to a better coverage of all weeks of the year and an increased sample size. Another recommendation clearly stated not to use this indicator as it “not an innovation indicator” and it is “not reliably measures”. Both claims were not elaborated and given the improvement in the reference period as explained before it is assumed that this is a reliable indicator.

- o Data source: Eurostat

- **1.1.4 Youth education attainment level (% of population aged 20-24 having completed at least upper secondary education)**

- o Numerator: Youth education attainment level is defined as the percentage of young people aged 20-24 years having attained at least upper secondary education attainment level, i.e. with an education level ISCED 3a, 3b or 3c long minimum (numerator). The denominator consists of the total population of the same age group, excluding no answers to the questions 'highest level of education or training attained'.
- o Denominator: The reference population is all age classes between 20 and 24 years inclusive.
- o Rationale: The indicator measures the qualification level of the population aged 20-24 years in terms of formal educational degrees. So far it provides a measure for the “supply” of human capital of that age group and for the output of education systems in terms of graduates. Completed upper secondary education is generally considered to be the minimum level required for successful participation in a knowledge-based society and is positively linked with economic growth.
- o Data source: Eurostat

- **1.1.5 Other indicators considered but not adopted**

Workshop participants recommended several other indicators to be included under Human resources:

- o It was suggested to include additional indicators that would capture training activities, vocational training and investments in competence. However, the indicator “life-long learning” due to its broader nature, captures the proposed concepts.
- o Human Resources in Science & Technology (HRST) aged 25-35 as a percentage of occupied population in the same age group.
  - Not included as this indicator clearly overlaps with indicator 1.1.2.
- o Growth in business researchers capturing “the diversified nature of researchers in businesses, regardless of their academic background”.
  - Not included as the EIS indicators are all level indicators. Including a growth indicator would unnecessarily complicate the calculation of the SII. There is also a clear overlap with the indicator on business R&D expenditures.

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<sup>7</sup> [http://epp.eurostat.ec.europa.eu/cache/ITY\\_SDDS/Annexes/tsiem080\\_sm1\\_an1.htm](http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/tsiem080_sm1_an1.htm)

- Graduation rates at doctoral level as a percentage of the relevant age cohort or Enrolment rates of 20-29-years old as a percentage of the population aged 20 to 29, where both could provide “a better indication of the responsiveness level of a system towards the demands for specialized skills for innovation”.
  - Both proposed indicators are not included as PhD’s graduates reflect a very narrow group of the population and people enrolled are not available for the labour market nor will all of these successfully complete their education. The EIS indicators 1.1.1 and 1.1.2 should already sufficiently capture the supply of highly-skilled workers.

### **3.1.2 Finance and support**

This dimension captures indicators measuring the availability of innovation finance and public support for innovation. The following indicators will be included:

- **1.2.1 Public R&D expenditures (% of GDP)**
  - Numerator: All R&D expenditures in the government sector (GOVERD) and the higher education sector (HERD). Both GOVERD and HERD according to the 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.
  - Rationale: R&D expenditure represents one of the major drivers of economic growth in a knowledge-based economy. As such, trends in the R&D expenditure indicator provide key indications of the future competitiveness and wealth of the EU. Research and development spending is essential for making the transition to a knowledge-based economy as well as for improving production technologies and stimulating growth.
  - Workshop recommendations: The workshop input paper suggested revising this indicator to capture only public R&D expenditure of relevance to businesses. Many participants argued in favour of maintaining the broad indicator of public R&D expenditure and this has been accepted. It was recommended to also add GNP expressions to the current GDP validations so as to better reflect the performance by indigenous enterprises as “new economies are increasingly open economies and the performance/influence of foreign owned companies distorts the performance by indigenous enterprises which is a more true economic measure”. However, this would create inconsistencies as most other major reports (as well as the EU's Lisbon target) are based on R&D expenditures as a share of GDP.
  - Data source: Eurostat
- **1.2.2 Venture capital (% of GDP)**
  - 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. Data are broken down into two investment stages: Early stage (seed + start-up) and Expansion and replacement (expansion and replacement capital). Seed is defined as financing provided to research, assess and develop an initial concept before a business has reached the start-up phase. 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 sold their product commercially. Expansion is defined as financing provided for the growth and expansion of a company which is breaking even or trading profitably. Capital may be used to finance increased production capacity, market or product development, and/or provide additional working capital. It includes bridge financing for the transition from private to public quoted company, and rescue/turnaround financing.

- Denominator: Gross domestic product as defined in the European System of Accounts (ESA 1995), in national currency and current prices.
  - Rationale: The amount of venture capital is a proxy for the relative dynamism of new business creation. In particular, for enterprises using or developing new (risky) technologies venture capital is often the only available means of financing their (expanding) business. By broadening the definition from early-stage VC only (EIS 2007) to early-stage and expansion VC the indicator will provide a better picture on the availability of a domestic VC industry and will also decrease volatility (following the comments by one of the workshop participants).
  - Workshop recommendations: Early-stage venture capital was considered by some an important indicator, with a high explanatory weight when considering, for example, the United States innovation performance. The suggestion made in the workshop input paper to consider removing this indicator was therefore not accepted. However, as this is a highly volatile indicator; two-year averages<sup>8</sup> will be used to reduce volatility rates. In addition an indicator of private credit is proposed to capture national contexts where such credit is important for financing innovation (cf. indicator 1.2.3).
  - Data source: EVCA/Eurostat
- **1.2.3 Ratio of credit towards the private sector from deposit-taking financial institutions relative to GDP**
    - Numerator: Claims on the private sector by commercial banks and other financial institutions that accept transferable deposits such as demand deposits.
    - Denominator: Gross domestic product as defined in the European System of Accounts (ESA 1995), in national currency and current prices.
    - Rationale: Following FORA's InnovationMonitor (FORA, 2007), the availability of private credit is used as an indicator for the supply of start-up capital.
    - Workshop recommendations: The validity of this indicator was questioned as, according to one of the workshop participants "there is no specific shortage in financial sources as such, and there are not really national financial markets but there is rather an integrated international financial market. Differences in the level of private credit availability will most likely reflect differences in the demand for loans to finance investment that bear bankable risks. The indicator may thus relate to macroeconomic indicators such as change in aggregated demand, gross investment or expenses of consumer for durables. What is more, within Euro-zone countries, inflation rate differentials become important, since in high-inflation Euro countries, real interest rates are low (since the interest rate for loans is basically the same in each Euro country) and demand for loans is higher (e.g. in Spain, Ireland). Changes in this indicator within Euro zone countries may reflect changes in inflation rate differentials." However, this indicator is the most

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<sup>8</sup> Further analyses of venture capital data will determine if two-year averages are sufficient to reduce data volatility or if three-year averages are necessary.

reliable available indicator for finance for innovation other than venture capital, and given the importance of finance as an enabler for innovation it is proposed to be included in the EIS. A study by Lederman and Maloney (2003) also shows that deeper capital markets as measured by the availability of private credit facilitate R&D investments.

- Data source: IMF

- **1.2.4 Broadband access**

- Numerator: Number of enterprises (excluding the financial sector) with 10 or more employees with broadband access.
- Denominator: Total number of enterprises (excluding the financial sector) with 10 or more employees.
- Rationale: Realising Europe's full e-potential depends on creating the conditions for electronic commerce and the Internet to flourish. This indicator captures the relative use of this e-potential by the number of enterprises that have access to broadband. The EIS 2007 indicator on broadband penetration also included household access and showed signs of reaching levels of saturation in several of the EU Member States. The new indicator focuses more on business performance and is far from reaching such levels of saturation with access rates for the best performing countries being below 40% in 2007.
- Workshop recommendations: Broadband was considered to be relevant as infrastructure that facilitates services' innovation and the spread of innovation and the suggestion in the workshop input paper to remove this indicator was therefore not accepted. It was also recommended to include mobile broadband access, and to only include higher bandwidths, but current data availability is insufficient.
- Data source: Eurostat

- **1.2.5 Other indicators considered**

Workshop participants recommended several other indicators to be included under Finance and support:

- Tax treatment of R&D both taking "into account the widening of innovation-targeted investments and the growing openness of innovation to wider forms of cooperation" and allowing "to capture a system's reaction to diversified innovation-targeted investments".
  - The indicator is not included as it would increase the acclaimed focus on R&D-based innovation.

## **3.2 Firm activities**

Firm activities capture innovation efforts at the firm level. The following indicators will be included.

### **3.2.1 Firm investments**

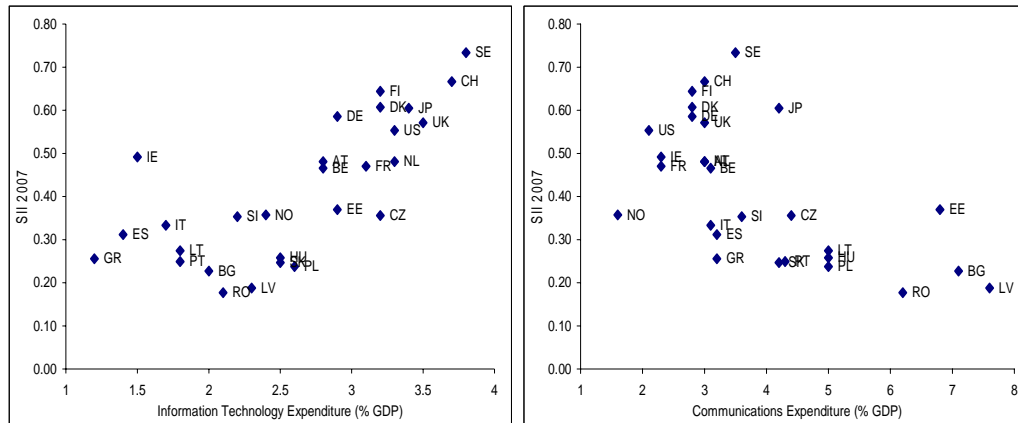
This dimension would replace the "Knowledge creation" dimension of the EIS 2007 and focuses on the relative size and distribution between sectors of performance of countries' R&D expenditures. R&D performance depends on the industrial structure and firms' size distribution and may be criticised as having a high tech bias. However, this bias should

be balanced out by the 'non-technological innovation' dimension<sup>9</sup>. The following indicators will be included:

- **2.1.1 Business R&D expenditures (% of GDP)**
  - Numerator: All R&D expenditures in the business sector (BERD), according to the 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.
  - Rationale: The indicator captures the formal creation of new knowledge within firms. It is particularly important in the science-based sector (pharmaceuticals, chemicals and some areas of electronics) where most new knowledge is created in or near R&D laboratories.
  - Workshop recommendations: this indicator was widely accepted as highly relevant to innovation performance. The proposal in the workshop input paper to remove the indicator on the share of medium-high/high-tech R&D was supported.
  - Data source: Eurostat
  
- **2.1.2 IT expenditures (% of GDP)**
  - Numerator: Total expenditures on IT, in national currency and current prices. IT expenditure expenditures capture hardware, software and other services. The data cover the total market, including expenditure of the public and private sector (enterprises, as well as those of individuals and households).
  - Denominator: Gross domestic product as defined in the European System of Accounts (ESA 1995), in national currency and current prices.
  - Rationale: IT is a fundamental feature of knowledge-based economies and the driver of current and future productivity improvements. An indicator of IT 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, with a lack of good information on the reliability of the data. Another disadvantage is that part of the expenditures is for final consumption and may have few productivity or innovation benefits.
  - Comment: The EIS 2007 indicator captured all ICT expenditures, thus both IT and Communications expenditure. The Communications component is no longer included as these expenditures appear to capture carrier services not related to innovation, in particular by several of the new member states (cf. the following two graphs on IT and communication expenditure relative to the 2007 Summary Innovation Index).

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<sup>9</sup> Future thematic papers under the EIS could investigate the use of industry adjusted indicators.



o Data source: EITO/Eurostat

• **2.1.3. Non-R&D innovation expenditures (% of total turnover)**

- o Numerator: Sum of total innovation expenditure for enterprises, in national currency and current prices excluding intramural and extramural R&D expenditures. (Community Innovation Survey)
- o Denominator: Total turnover for all enterprises, in national currency and current prices. (Community Innovation Survey)
- o Rationale: This indicator measures non-R&D innovation expenditure<sup>10</sup> as percentage of total turnover. 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. Compared to the EIS 2007 the indicator no longer captures intramural and extramural R&D expenditures and thus no longer overlaps with the indicator on business R&D expenditures.
- o Workshop recommendations: Many workshop participants agreed with this indicator. However there were some concerns about the reliability of Community Innovation Survey data, and an alternative suggestion for this indicator was to use the ratio of gross fixed capital formation in metal products, machinery and transport equipment to gross fixed assets in metal products, machinery and transport equipment. However, other participants pointed to improved quality of the Community Innovation Survey.
- o Data source: Eurostat (Community Innovation Survey)

<sup>10</sup> This strategy of “non-R&D innovation” is more prevalent amongst services and low-tech manufacturing sectors (cf. Huang et al. (2008) for a discussion on why firms decide not to invest in R&D and Arundel et al. (2008) for a detailed analysis of non-R&D innovators). This analysis also shows that there is no significant difference in performance (growth in revenue) between R&D innovators and non-R&D innovators.

### 3.2.2 Linkages & entrepreneurship

Entrepreneurship, networks and linkages between actors have been considered key concepts in innovation by workshop participants. Participants stressed the importance of co-operation not only at national but also at international level, reflecting diffusion of innovation among actors. Indicators of scientific publications and co-patents are indicative of levels of cooperation. The following indicators will be included:

- **2.2.1 SMEs innovating in-house (% of all SMEs)**
  - Numerator: Sum of SMEs with in-house innovation activities. Innovative firms are defined as those firms which have introduced new products or process either 1) in-house or 2) in combination with other firms. This indicator does not include new products or processes developed by other firms. (Community Innovation Survey)
  - Denominator: Total number of SMEs. (Community Innovation Survey)
  - Rationale: This indicator measures the degree to which SMEs, that have introduced any new or significantly improved products or production processes during the period 2002-2004, have innovated in-house. The indicator 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.
  - Data source: Eurostat (Community Innovation Survey)
  
- **2.2.2 Innovative SMEs co-operating with others (% of all SMEs)**
  - 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. (Community Innovation Survey)
  - Denominator: Total number of SMEs. (Community Innovation Survey)
  - Rationale: This indicator measures the degree to which SMEs are involved in innovation co-operation. Complex innovations, in particular 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.
  - Data source: Eurostat (Community Innovation Survey)
  
- **2.2.3 Firm renewal (SMEs entries and exits as a % of all SMEs)**
  - Definition: The indicator is defined as the sum of the number of births of enterprises and the number of deaths of enterprises divided by the number of all firms.
  - Numerator: A birth amounts to the creation of a combination of production factors with the restriction that no other enterprises are involved in the event. Births do not include entries into the population due to mergers, break-ups, split-off or restructuring of a set of enterprises. It does not include entries into a sub-population resulting only from a change of activity. A birth occurs when an enterprise starts from scratch and actually starts activity. An enterprise creation can be considered as an enterprise birth if new production factors, in particular new jobs, are created. If a dormant unit is reactivated within two years, this event is not considered a birth. A death amounts to the dissolution of a combination of production

factors with the restriction that no other enterprises are involved in the event. Deaths do not include exits from the population due to mergers, take-overs, break-ups or restructuring of a set of enterprises. It does not include exits from a sub-population resulting only from a change of activity. An enterprise is included in the count of deaths only if it is not reactivated within two years. Equally, a reactivation within two years is not counted as a birth.

- Denominator: Total number of SMEs.
  - Comment: Following comments from the EIS workshop 16 June 2008, only firms with at least 5 employees and who are active in NACE classes C, D, E, G51, I, J and K are included “in order to avoid measuring firm turbulence in retail trade, restaurants, construction services and other sectors that are predominantly based on non-innovation competition”.
  - Rationale: An important aspect of this dimension is the existence of new firms in an economy which would signal to an innovative environment, where enterprise births (creation) take place in parallel with enterprises death (discontinuation) and survival, reflecting what is known as “creative destruction”. According to Eurostat report (2008) on enterprises birth, survival and death, based on data of 15 member states for 2005, enterprises born in 2005 represented about 10% of all active enterprises. Employment in newly born enterprises tended to offset employment losses as a result of enterprises death. As for surviving firms, those that survive employed more persons than the initial employment levels among all newly born enterprises in 2000. These statistics point to the relevance of new firms in the economy, even though there were significant differences among member states and economic sectors.
  - Data source: Eurostat
- **2.2.4 Scientific public-private co-publications per million population**
    - Numerator: Number of public-private co-publications.
    - Denominator: Total population as defined in the European System of Accounts (ESA 1995).
    - Rationale: This indicator will capture public-private linkages by active collaboration activities between business sector researchers and university researchers resulting in academic publications.
    - Comment: This inclusion of this indicator is pending on data availability.
    - Workshop recommendations: COTEC (Simões, 2008) proposed including scientific publications as an enablers’ indicator. Another recommendation clearly stated to use publications and not to use co-publications as the latter are “a very narrow measure of R&D activity and there is no public source that measures this directly”.
    - Data source: Thomson/ISI

- **2.2.5 Other indicators considered**

Workshop participants recommended several other indicators to be included:

- Relative prominence of cited scientific literature capturing “the relevance of IP and scientific advanced for innovation”.
- Percent of international collaboration on S&E articles as a share of a country’s total article output reflecting “the international dimension in a country’s knowledge base”.

- Both indicators will not be included as the EIS as they are more measures of research performance. In addition, one indicator using publications data is already to be included.
- Survival rates, businesses entries and exits were suggested to measure entrepreneurship activities within countries.
  - The indicator of firm renewals was considered to be the strongest indicator of this type.
- The Global Entrepreneurship Monitor<sup>11</sup> was recommended as source of data about early-stage entrepreneurial activity instead of using entry-exit rates. However, there were concerns about the use of this data as it measures aspirations and further exploration is needed.
- The World Bank Doing Business indicators were suggested. However this set of indicators appear more relevant for the environment for starting business rather than the level of entrepreneurial innovation.

### 3.2.3 Throughputs

This dimension should capture some of the intermediate results from the innovation process. The IPR indicators from the EIS 2007 “intellectual property” dimension could be included in this dimension, including patents resulting from technological innovation and trademarks and industrial designs also resulting from non-technological and services innovation. Workshop participants suggested that differences among sectors should be considered in the EIS. This sectoral approach is captured by using both technological and non-technological throughput indicators, reflecting different types of innovation, innovation modes and economic specialization of countries. The following indicators will be included:

- **2.3.1 EPO patents per million population**
  - 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).
  - Rationale: The capacity of firms to develop new products will determine their competitive advantage. One indicator of the rate of new product innovation is the number of patents. This indicator measures the number of patent applications at the European Patent Office.
  - Workshop recommendations: The proposal in the workshop input paper to remove the indicator on USPTO and triad patents was supported.
  - Data source: Eurostat
- **2.3.2 Community trademarks per million population**
  - Numerator: Number of new community trademarks. A trademark is a distinctive sign, which identifies certain goods or services as those produced or provided by a specific person or enterprise. The Community trademark offers the advantage of uniform protection in all countries of the European Union on the strength of a single registration procedure with the Office for Harmonization.

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<sup>11</sup> <http://www.gemconsortium.org/>

- Denominator: Total population as defined in the European System of Accounts (ESA 1995).
  - Rationale: "Trademarks are an important innovation indicator, especially for the service sector" (Frietsch, 2005). The Community trademark gives its proprietor a uniform right applicable in all Member States of the European Union on the strength of a single procedure which simplifies trademark policies at European level. It fulfils the three essential functions of a trademark at European level: it identifies the origin of goods and services, guarantees consistent quality through evidence of the company's commitment vis-à-vis the consumer, and is a form of communication, a basis for publicity and advertising. The Community trademark may be used as a manufacturer's mark, a mark for goods of a trading company, or service mark. It may also take the form of a collective trademark: properly applied, the regulation governing the use of the collective trademark guarantees the origin, the nature and the quality of goods and services by making them distinguishable, which is beneficial to members of the association or body owning the trademark.
  - Comment: "The community trademark is only one system that can be used to gain trademarks protection in EU countries" so it would be appropriate to also include data on trademarks from WIPO for non-EU countries.
  - Comment: this is a rapidly increasing indicator; two-year averages will be used to reduce rates of annual change.
  - Workshop recommendations: data on trademarks was considered relevant to reflect non-technological innovation activities.
  - Data source: OHIM
- **2.3.3 Community designs per million population**
    - Numerator: Number of new community designs. A registered Community design is an exclusive right for the outward appearance of a product or part of it, resulting from the features of, in particular, the lines, contours, colours, shape, texture and/or materials of the product itself and/or its ornamentation.
    - Denominator: Total population as defined in the European System of Accounts (ESA 1995).
    - Rationale: A design is the outward appearance of a product or part of it resulting from the lines, contours, colours, shape, texture, materials and/or its ornamentation. A product can be any industrial or handicraft item including packaging, graphic symbols and typographic typefaces but excluding computer programs. It also includes products that are composed of multiple components, which may be disassembled and reassembled. Community design protection is directly enforceable in each Member State and it provides both the option of an unregistered and a registered Community design right for one area encompassing all Member States.
    - Comment: It would be appropriate to also include data on trademarks from WIPO for non-EU countries.
    - Comment: this is a rapidly increasing indicator; two-year averages will be used to reduce rates of annual change.
    - Workshop recommendations: information related to design was considered relevant to reflect soft-innovation and creative industries.
    - Data source: OHIM

### 3.3 Outputs

Outputs capture the results of innovation both the relative prominence of innovating firms and by several economic effects of innovation activities and the results of innovation in high-tech and knowledge-intensive industries. The following indicators will be included:

#### 3.3.1 Innovators

In terms of types of innovators (technological, non-technological, organizational and marketing), workshop participants suggested reflecting both embodied and disembodied technologies, but with special care when using “perception based” indicators, which are collected in the CIS – Community Innovation Survey. For this reason, these indicators received a lower weight when compared to other indicators.

Furthermore, different types of innovators reflect different innovation modes and take into account sector differences (both tangibles and intangibles outputs), a suggestion that was also considered in the sub-dimension “throughputs” within the dimension “Firms activities”.

- **3.1.1 Technological (product or process) innovators (% of all SMEs)**
  - Numerator: The number of SMEs who introduced a new product or a new process to one of their markets.
  - Denominator: Total number of SMEs.
  - Rationale: Technological innovation as measured by the introduction of new products (goods or services) and processes is key to innovation in manufacturing activities. Higher shares of technological innovators should reflect a higher level of innovation activities.
  - Data source: Eurostat (Community Innovation Survey)
  
- **3.1.2 Non-technological (marketing or organisational) innovators (% of all SMEs)**
  - Numerator: The number of SMEs who introduced a new marketing innovation or organisational innovation to one of their markets.
  - Denominator: Total number of SMEs.
  - Rationale: The Community Innovation Survey mainly asks firms about their technical innovation. Many firms, in particular in the services sectors, innovate through other non-technological forms of innovation. Examples of these are organisational innovations. This indicator tries to capture the extent that SMEs innovate through non-technological innovation.
  - Data source: Eurostat (Community Innovation Survey)
  
- **3.1.3 Resource efficiency innovators**

This indicator is captured by the following two sub-indicators each contributing for 50% of the overall score for resource efficiency innovators:

  - **3.1.3a Reduced labour costs resulting from process innovations**
    - Numerator: Sum of innovating firms who replied that their product or process innovation had a highly important effect on reducing labour costs per unit of output.
    - Denominator: Total number of innovating firms.

- Rationale: This indicator captures the cost savings from process innovation.
  - Comment: this indicator will be included jointly with indicator 3.1.3b using a relative weight of 50%.
  - Workshop recommendations: Participants suggested measuring innovation efficiency and labour costs savings.
  - Data source: Eurostat (Community Innovation Survey)
- **3.1.3.b Reduced use materials and energy resulting from process innovations**
    - Numerator: Sum of innovating firms who replied that their product or process innovation had a highly important effect on reducing materials and energy per unit of output.
    - Denominator: Total number of innovating firms.
    - Rationale: This indicator captures the energy savings from process innovation.
    - Comment: this indicator will be included jointly with indicator 3.1.3b using a relative weight of 50%.
    - Workshop recommendations: Participants suggested the inclusion of indicators that would reflect eco-innovation and costs / energy savings.
    - Data source: Eurostat (Community Innovation Survey)

### 3.3.2 Economic performance

This dimension would correspond to the EIS 2007 “Applications” dimension. A criticism of this dimension is that it focuses too much on high-tech performance<sup>12</sup> Here one could better integrate the economic outputs of innovation, e.g. level and/or growth in labour productivity with several of the current EIS indicators. The following indicators will be included:

- **3.2.1 Employment in knowledge-intensive services (% of total workforce)**
  - Numerator: Number of employed persons in the knowledge-intensive services sectors. These include water transport (NACE 61), air transport (NACE 62), post and telecommunications (NACE64), financial intermediation (NACE 65), insurance and pension funding (NACE 66), activities auxiliary to financial intermediation (NACE 67), real estate activities (NACE 70), renting of machinery and equipment (NACE 71), computer and related activities (NACE72), research and development (NACE73) and other business activities (NACE 74).
  - Denominator: The total workforce includes all manufacturing and service sectors.
    - Rationale: Knowledge-intensive services 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, in particular those based on ICT.
    - Workshop recommendation: It was suggested to include not only high-tech manufacturing but also knowledge intensive services. This suggestion is in line with comments stressing the importance of

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<sup>12</sup> Schibany et al., 2007

countries' economic specialization, sectoral differences and different innovation modes.

- o Data source: Eurostat

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

- o Numerator: Number of employed persons in the medium-high and high-tech manufacturing sectors. These include chemicals (NACE24), machinery (NACE29), office equipment (NACE30), electrical equipment (NACE31), telecommunications and related equipment (NACE32), precision instruments (NACE33), automobiles (NACE34) and aerospace and other transport (NACE35).
- o Denominator: The total workforce includes all manufacturing and service sectors.
- o Rationale: The share of employment in high technology manufacturing sectors is an indicator 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.
- o Data source: Eurostat

- **3.2.3 Exports of high technology products as a share of total exports**

- o Numerator: Value of high-tech exports, in national currency and current prices. High-tech exports include exports of the following products: aerospace; computers and office machinery; electronics-telecommunications; pharmaceuticals; scientific instruments; electrical machinery; chemistry; non-electrical machinery and armament (cf. OECD STI Working Paper 1997/2 for the SITC Revision 3 codes).
- o Denominator: Value of total exports, in national currency and current prices.
- o Rationale: The indicator measures the technological competitiveness of the EU i.e. the ability to commercialise the results of research and development (R&D) and innovation in the international markets. It also reflects product specialisation by country. Creating, exploiting and commercialising new technologies are vital for the competitiveness of a country in the modern economy. This is because high technology sectors are key drivers for economic growth, productivity and welfare, and are generally a source of high value added and well-paid employment. The Brussels European Council (2003) stressed the role of public-private partnerships in the research area as a key factor in developing new technologies and enabling the European high-tech industry to compete at the global level.
- o Workshop recommendations: This indicator was criticized for not measuring performance but rather industry structure "(since a country with a very small high-tech sector would not be able to obtain a high share of high-tech products in total exports, even if the country's high-tech sector is extremely successful in transferring R&D into global sales of new products)". An alternative indicator would be the Trade balance in medium-high and high-tech products as a percentage of GDP) capturing "the ability of a country to sell more technology products abroad than it purchases from other countries".
- o Data source: Eurostat

- **3.2.4 Exports of knowledge-intensive services as a share of total services exports**
  - Numerator: Exports of knowledge-intensive services are measured by the sum of credits in EBOPS (Extended Balance of Payments Services Classification) 207, 208, 211, 212, 218, 228, 229, 245, 253, 254, 260, 263, 272, 274, 278, 279, 280 and 284. Total KIS exports will be overestimated as EBOPS 285 also covers activities in ISIC 90 Sewage and refuse disposal, sanitation and similar activities but we expect that this overestimation is only small.
  - Denominator: Total services exports as measured by credits in EBOPS 200.
  - Rationale: The indicator measures the competitiveness of the knowledge-intensive services sector. The indicator is comparable to indicator 3.2.3 on high-tech manufacturing export performance.
  - Data source: Eurostat (Balance of Payments statistics)
  
- **3.2.5 Sales of new-to-market products (% of total turnover)**
  - Numerator: Sum of total turnover of new or significantly improved products for all enterprises. (Community Innovation Survey)
  - Denominator: Total turnover for all enterprises, in national currency and current prices. (Community Innovation Survey)
  - Rationale: This indicator measures the turnover of new or significantly improved products, which are also new to the market, as a percentage of total turnover. 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.
  - Data source: Eurostat (Community Innovation Survey)
  
- **3.2.6 Sales of new-to-firm products (% of total turnover)**
  - Numerator: Sum of total turnover of new or significantly improved products to the firm but not to the market for all enterprises. (Community Innovation Survey)
  - Denominator: Total turnover for all enterprises, in national currency and current prices. (Community Innovation Survey)
  - Rationale: This indicator measures the turnover of new or significantly improved products to the firm as a percentage of total turnover. These products are not new to the market. Sales of new to the firm but not new to the market products are a proxy of the use or implementation of elsewhere already introduced products (or technologies). This indicator is thus a proxy for the degree of diffusion of state-of-the-art technologies.
  - Data source: Eurostat (Community Innovation Survey)
  
- **3.2.7 Technology Balance of Payments**
  - Numerator: Receipts minus payments for technical knowledge and services
  - Denominator: Gross domestic product
  - Rationale (OECD, Science, Technology and Industry Scoreboard 2007): Technology receipts and payments constitute the main form of disembodied technology diffusion. Trade in technology comprises four main categories: Transfer of techniques (through patents and licences,

disclosure of know-how); Transfer (sale, licensing, franchising) of designs, trademarks and patterns; Services with a technical content, including technical and engineering studies, as well as technical assistance; and Industrial R&D. Although the balance reflects a country's ability to sell its technology abroad and its use of foreign technologies, a deficit does not necessarily indicate low competitiveness. In some cases, it results from increased imports of foreign technology; in others, it is due to declining receipts. Likewise, if the balance is in surplus, this may be due to a high degree of technological autonomy, a low level of technology imports or a lack of capacity to assimilate foreign technologies. Most transactions also correspond to operations between parent companies and affiliates. Thus, it is important to have additional qualitative and quantitative information in order to analyse correctly a country's deficit or surplus position in a given year. There is also the difficulty of dissociating the technological from the non-technological content of trade in services, which falls under the heading of pure industrial property. Thus, trade in services may be underestimated when a significant portion does not give rise to financial payments or when payments are not in the form of technology payments.

- o Data source: World Bank
- o Workshop recommendations: COTEC (Simões, 2008) recommends including TBP payments and receipts as separate indicators. TBP payments would be included under firm activities capturing disembodied technology acquisition. TBP receipts would be included under outputs capturing disembodied technology exports.

#### **4. Conclusions and further recommendations**

In the previous sections we have presented the new set of dimensions and indicators to be included in the EIS 2008-2010 following the proposals from the workshop input paper (Hollanders and van Cruysen, 2008), the discussions at the workshop and written comments received after the workshop.

Workshop participants also suggested several more general recommendations:

- o There are strong differences in opinion about the use of CIS data. Some workshop participants considered these data as unreliable as they are perception based and thus difficult to compare across countries (and over time). Others, including participants involved in the collection of CIS data in their countries, were in favour of using CIS data. As the CIS was specifically designed to measure innovation activities and their effects, this survey will be used for the EIS so as to "provide a comparative assessment of the innovation performance of EU Member States".
- o It was also recommended to include a second set of indicators in addition to the set of "core" EIS indicators relevant to innovation, e.g. on socio-economic conditions (cf. the thematic paper on socio-economic conditions (Hollanders and Arundel, 2007)), which could be used for experimental analyses. This will be the subject of EIS thematic papers which will include analysis of how these wider indicators relate to innovation performance as measured by the EIS Summary Innovation Index. However, if feasible, such data will be included in the EIS database to be made available on the EIS website.

Finally, this Output paper will be followed by a final methodology report in the Autumn covering both the before-mentioned Input paper and this Output paper plus sections

explaining the calculation of the Summary Innovation Index and other composite indicators, changes over time (cf. Tarantola, 2008a), new graphical presentations of EIS results (cf. Tarantola, 2008b) and a section discussing an adapted EIS for international comparisons with non-EU countries.

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## Annex 1: EIS 2007 Indicators

<b>INNOVATION DRIVERS (INPUT DIMENSION)</b>		
1.1	S&E graduates per 1000 population aged 20-29	EUROSTAT
1.2	Population with tertiary education per 100 population aged 25-64	EUROSTAT, OECD
1.3	Broadband penetration rate (number of broadband lines per 100 population)	EUROSTAT, OECD
1.4	Participation in life-long learning per 100 population aged 25-64	EUROSTAT
1.5	Youth education attainment level (% of population aged 20-24 having completed at least upper secondary education)	EUROSTAT
<b>KNOWLEDGE CREATION (INPUT DIMENSION)</b>		
2.1	Public R&D expenditures (% of GDP)	EUROSTAT, OECD
2.2	Business R&D expenditures (% of GDP)	EUROSTAT, OECD
2.3	Share of medium-high-tech and high-tech R&D (% of manufacturing R&D expenditures)	EUROSTAT, OECD
2.4	Share of enterprises receiving public funding for innovation	EUROSTAT (CIS4)
<b>INNOVATION &amp; ENTREPRENEURSHIP (INPUT DIMENSION)</b>		
3.1	SMEs innovating in-house (% of all SMEs)	EUROSTAT (CIS4)
3.2	Innovative SMEs co-operating with others (% of all SMEs)	EUROSTAT (CIS4)
3.3	Innovation expenditures (% of total turnover)	EUROSTAT (CIS4)
3.4	Early-stage venture capital (% of GDP)	EUROSTAT
3.5	ICT expenditures (% of GDP)	EUROSTAT, WORLD BANK
3.6	SMEs using organisational innovation (% of all SMEs)	EUROSTAT (CIS4)
<b>APPLICATIONS (OUTPUT DIMENSION)</b>		
4.1	Employment in high-tech services (% of total workforce)	EUROSTAT
4.2	Exports of high technology products as a share of total exports	EUROSTAT
4.3	Sales of new-to-market products (% of total turnover)	EUROSTAT (CIS4)
4.4	Sales of new-to-firm products (% of total turnover)	EUROSTAT (CIS4)
4.5	Employment in medium-high and high-tech manufacturing (% of total workforce)	EUROSTAT, OECD
<b>INTELLECTUAL PROPERTY (OUTPUT DIMENSION)</b>		
5.1	EPO patents per million population	EUROSTAT, OECD
5.2	USPTO patents per million population	EUROSTAT, OECD
5.3	Triad patents per million population	EUROSTAT, OECD
5.4	New community trademarks per million population	OHIM, EUROSTAT, OECD
5.5	New community designs per million population	OHIM, EUROSTAT, OECD