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ECONOMY
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Workpackage 1
Policies for a Knowledge-Based Economy

Deliverable 1.3

2008

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1. Introduction

For policymakers in industrialized economies, the development of a knowledge based economy (KBE) is viewed as essential for economic growth in the face of increased competition from lower cost countries in both basic manufacturing and in higher skilled services and production. The ability of European countries to face the challenge posed by competition from these emerging countries, exemplified by China and India, will partly determine how the EU fares. At the same time, the EU will face continued pressure from countries such as the United States and Japan, two countries identified as the major competitors in European policy documents since 1995[1].

The concept of a 'knowledge economy' tends to focus thoughts on existing policies to promote ICT use, including e-government and e-commerce; R&D, and education. However, a broad range of policies are relevant to the goal of promoting a KBE. This includes policies to promote organizational and "presentational" innovation and "soft" parameters such as human creativity (Florida, 2005) and human resource management. The goal is to develop policy based on concrete evidence, but this goal creates several challenges. Not only is there a lack of empirical evidence for present developments in the KBE, but policy must also address future trends and uncertainty. Good policymaking must also incorporate political, economic, and cultural contexts.

A key European policy initiative of relevance to a KBE is the Barcelona objective to increase European R&D intensity from 1.9% in 2001 to 3.0% of GDP in all member countries by 2010. Moreover, two-thirds of the spending is to originate in the private sector. This goal to transform the European market into the world's most competitive[2] region has served as a powerful signal of the European resolve to bring divergent national R&D efforts up one level, which is a positive feature. The 3% goal is a strong motivator for the policy community in that progress can be measured (e.g. growth in GDP) and government policies can have a direct effect on R&D investments.

The Barcelona objective is also an example of some of the potential problems for policy development. The danger is that the 3% goal can focus policy efforts on outcomes that are easy to measure because adequate data and indicators, such as R&D investment, are readily available, in contrast to a lack of data and indicators for other KBE goals. The disparity in data and indicator availability could distract the policy community from pursuing other important policies for encouraging growth in a KBE.

A second challenge for evidence-based policy is to measure the effect of government programmes on policy goals when a large number of factors can influence outcomes. For

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[1] These and other challenges facing European progress towards a KBE are covered in WP 1.2.
[2] 'defined' as "the most dynamic and competitive knowledge-based economy in the world while capable of sustainable economic growth with more and better jobs and greater social cohesion, and respect for the environment".

example, over the past decade national governments and the EU have introduced policies to increase the use of patents and other IPRs by European firms. 'Success' can be tracked through a range of high quality patent indicators. Patent data show a recent decline in patenting, rather than the hoped for increase. Yet, it is difficult to determine if the decline is due to a failure of pro-patent policies, or to a change in other factors that influence patenting. These include changes in technological opportunity, the efficiency of R&D, and the strategic value of patents to firms. Identifying the effect of these factors on how firms use IPRs requires a variety of different indicators, many of which are unavailable except as one-off indicators collected in a single survey at a single point in time. Similar problems occur for measuring the effects of other relevant policies to promote a KBE, such as policies to promote public sector innovation or to improve the quality of human capital.

A third challenge is that policy formulation must address the way we want our economies and society to look in 2025. Consequently, policy making requires indicators of relevance to medium- and long-term goals. A key limitation with any discussion of policy is the time-lag inherent in policy formulation and implementation and in the timeliness of data and indicators to measure policy outcomes. For example, current indicators for scientific publications and patenting measure the effect of past R&D efforts and past policies to promote research. The time lag between research and publication is some three to five years. Thus, the effect of current policies to promote research may not be visible in the publication record for five years, and even longer for other outputs such as a new stream of innovations. In this instance, policy is learning from the past to plan for the future and although helpful, this can also tie the hands of policy makers who have to implement programmes to support future growth.

In order to address the policy challenges of a KBE, we need to consider policy from two dimensions. First, what policies are currently in place and are they capable of meeting current challenges? Second, can policies be designed with sufficient flexibility to adapt to possible future challenges?

This report focuses on policies currently in place and evaluates the relevance of some of the key national and European policies for promoting a KBE in light of the Lisbon and Barcelona objectives[3]. This requires a careful evaluation of the current variety of innovation, science, technology, education and immigration policies, and their positioning within country-specific macro economic and structural contexts. Policy builds on previous perceived challenges and opportunities, and so a brief description of the evolution of European policies of relevance to a KBE is given in Section 2. Section 3 highlights the main differences between European, OECD and United States policy responses to the five main characteristics of knowledge-based economies. It evaluates particular issues related to the role of ICT, the public sector, services and intellectual Property Rights (IPR). An overview of national policies is provided

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[3] The second dimension of future policy scenarios is addressed in Report 1.4 Policy Scenarios.

in Section 4. A series of interviews with policy and decision makers about current indicators and directions for the future was carried out and the key findings are presented in Section 5.

2. Evolution of European KBE Policies

The subsidiarity principle of the European Union limits the direct role of the European Commission in implementing policies of relevance to a KBE. The major exception is support for supra-national cooperative research programmes such as the Research and Technology Development (RTD) Framework Programmes and EUREKA.[4] The Framework Programmes encourage the sharing of knowledge by providing financial subsidies to collaborative research projects that involve multiple partners, drawn from either the private sector or from public research institutions (PRIs). The Commission, however, also plays an important role in KBE policy through its efforts to identify relevant policies, set EU-wide goals, and provide a forum for setting standards, such as in education. This section evaluates the Commission's role in innovation, education, and ICT policy.

2.1 Innovation Policy

The EU has had an official innovation policy since the 1995 Green Paper on Innovation, developed in consultation with Member States, industry and other actors. The Green Paper led to the *First Action Plan for Innovation in Europe* (1996), which provided a detailed set of objectives for co-ordinated action by the Commission and Member States. The First Action Plan addressed three issues:

- Fostering an innovation culture
- Creating an environment conducive to innovation, and
- Orienting research to innovation.

The progress report for the First Action Plan[5] reviewed six priority areas:

- Protection of intellectual property
- Financing innovation
- The regulatory framework and administrative simplification
- Education and training
- Gearing research towards innovation, and
- Strengthened overall co-ordination.

The European Union has had a policy of supporting science and technology through its framework programme for two decades with the aim of fostering collaboration between European researchers. The First Action Plan failed to fully address the fragmented and

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[4] See Caloghirou et al. (2006) and Peterson and Sharp (1998) for extensive discussions of cooperative R&D and related policies in Europe.
[5] Innovation for Growth and Employment, 1998.

inefficient use of resources. To remedy this, the 2000 Lisbon Council laid the foundations for a European Research Area (ERA) as a first step towards a common European science and technology policy across the Union. The goal of the ERA is to coordinate national research policies towards shared objectives, expertise and resources; to stimulate the sharing of knowledge across borders, including information exchange through greater mobility, and consequently to decrease repetition in research and to increase the efficiency of European research. The European Council of 2000 emphasised innovation's importance as the main source of competitiveness and economic growth and its key role in the ERA. The report *Innovation in a Knowledge-Driven Economy* (EC, 2000) responded to the goals set by the Lisbon Council by defining a timetable for concrete progress towards five innovation-related objectives:

1. Coherence of innovation policies,
2. A regulatory framework conducive to innovation,
3. Encourage the creation and growth of innovative enterprises,
4. Improve key interfaces in the innovation system, and
5. A society open to innovation.

The report recognized the need for relevant indicators, and consequently included the pilot edition of the European Innovation Scoreboard.

In 2001, recognition of the important role of science in European society was circulated through various Commission publications.[6] In the same year, the need for risk capital was again emphasized.[7] The need for increased funding of science and innovation was given further attention in 2002 when the European Council, during its meeting in Barcelona, called for "a significant boost of the overall R&D and innovation effort in the Union, with a particular emphasis on frontier technologies". In 2003, the Commission emphasized the importance of innovation and reiterated its commitment to the 3% R&D intensity target, while at the same time stating that there are many other forms of innovation.[8] These include technological innovation (primarily stemming from research), organisational innovation or business model innovation (related to innovative ways of organising work in areas such as workforce management, distribution, finance and manufacturing), and presentational innovation (innovations in design and marketing). Finally, in its conclusions in March 2004, the Competitive Council suggested priorities for relevant elements of the existing body of EU legislation in terms of its cumulative impact on competitiveness and innovation. The Council called on the Commission to set out how it intends to move the new pro-active approach to

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[6] A European wide 'European Science and Society Action Plan' promoted a scientific culture in Europe (COM(2001) 714 final), in addition to the Commission staff working paper "Science, society and the citizen in Europe" (SEC(2000)1973, 14.11.2000).

[7] The Commission released a communication on State aid and risk capital (OJ C 235, 21.08.2001, p-3-11).

[8] "Innovation policy: updating the Union's approach in the context of the Lisbon strategy", COM(2003) 112 final; "Investing in Research :An Action Plan for Europe ("3 % Target") COM(2003) 226 final; and Commission staff working paper SEC(2003) 489.

competition policy forward. It also recommended that a higher proportion of the EU budget be invested in research and innovation, as well as the enhancing of linkages between research and business and the fostering of innovation.

The Barcelona target for R&D intensity is intended to narrow the gap with R&D investments in Japan and the United States. Figure 1 shows the trends in R&D intensity and suggests the growth that would be required to close the gap. One can observe the gap narrowing between the US and the EU-15 but this is due more to a drop in US efforts than EU-15 progress. The figures for the EU-15 show that the growth in R&D intensity ceased in 2003.

Figure 1. R&D intensity for EU-15 and selected countries, 1993 to 2003.

Source: Based on OECD Main Estimates for S&T, 2005.
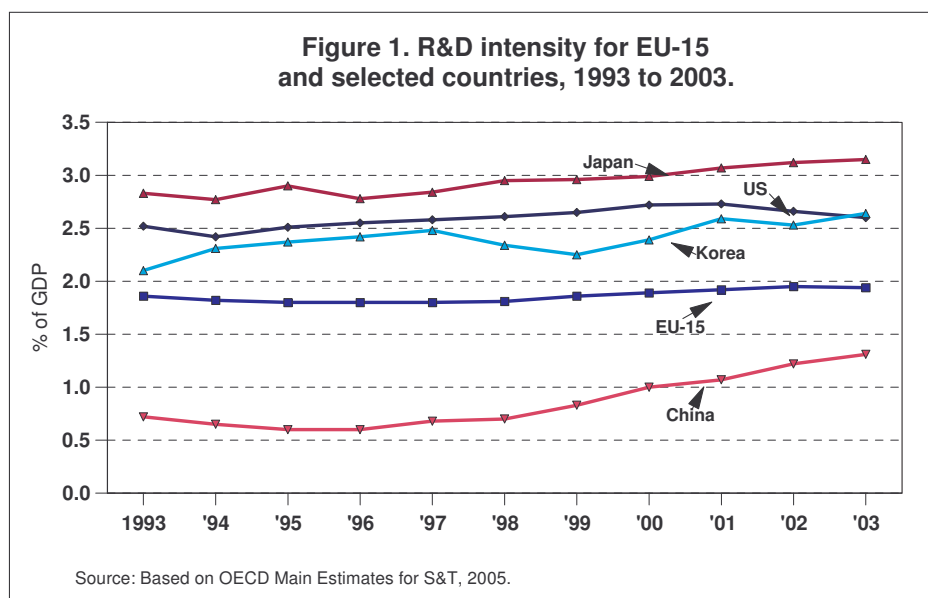
The year 2003 saw Korea surpass US efforts and the gap with the EU-15 is widening. One can see the significant growth of R&D in China, increasing from 1.0% of GDP in 2000 to reach 1.3% in 2003.

The EU has made some progress towards its goals, but there is growing concern that the reform process is not proceeding fast enough to reach its targets within the given time frame. In March 2004, a high level group chaired by Wim Kok was mandated by the European Council to evaluate policy recommendations from the original Lisbon Strategy. The result was several proposed revisions, a large part of which recognised the new set of challenges facing Europe (refer to KEI deliverable 1.2).

The most recent EU policy document on innovation is the *Draft Innovation Action Plan* (DG Enterprise). The Plan attaches great importance to presentational innovation, a better regulatory environment, improvement of the market for knowledge, and it places enterprises at the centre of innovation policy. It emphasises the importance of both technological and non-technological innovation (see Annex A for details). It targets all sectors including services, manufacturing and traditional sectors such as agriculture, and takes into account the

all-embracing nature of innovation.

In a communication on 'A New Start for the Lisbon Strategy' (February 2005), President Barroso of the European Commission (EC, 2005) stressed the need for policies to support economic growth and jobs. A central part of the strategy is the support of 'knowledge and innovation' as the key characteristics of a KBE and drivers of productivity growth. The February 2005 communication provides a range of policy recommendations to promote growth and jobs as well as knowledge and innovation within the European Union.

Since 1995, these various plans have coalesced to form a coherent strategy to address the major issues at stake for innovation in enterprises: to develop knowledge by fostering research, to enhance entrepreneurial spirit in Europe and identify business opportunities, and finally to bring these and other elements (such as human capital, finance and innovation-friendly regulation) together to facilitate innovation in enterprises and to exploit market opportunities for innovative goods and services.

The main themes of European Innovation policy in 1995, 2000, and 2005 are summarized in Table 1. In some respects, differences envisioned in the innovation programmes of the European Commission were perhaps of less significance in their implementation and ended in being more of a repackaging of similar ideas than new directions. For example, the 1995 'route of action' "to promote intellectual and industrial property" evolved into "make the most of intellectual property opportunities" in 2005. The 2000 objective to create 'a regulatory framework conducive to innovation' is covered by three routes of action in 1995 (set up a fiscal regime beneficial to innovation, simplify administrative procedures, and a favourable legal and regulatory framework) and by two 'envisaged actions' in 2005 to "promote technical regulations and standards that foster innovation and increase synergies between innovation and State aid policies". Emphasis on the various policy components has undergone some shifts. For example, the Barcelona target on R&D down-played the importance of the diffusion of innovations but this topic was taken up again in the recent focus on economic growth and jobs and by DG Enterprise's *Draft Action Plan*.

A new development in the *Draft Action Plan* that was not identified in previous EC documents on innovation is a focus on organisational innovation and presentational innovation such as trademarks, brands, and design. These are not separated into specific envisaged actions as in Table 1, but run throughout the Action Plan.[9] Technological innovation represents the traditional innovation perspective, but organisational and presentational innovations are a new development within innovation policy. Both are also included for the first time in the third revision of the OECD's Oslo Manual (2005), which provides the theoretical basis for innovation survey research. This broadened innovation perspective could have major policy implications. Given intense competition from low-cost manufacturers in developing countries, the competitive gains achievable through productivity

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[9] Included in *Envisaged Action 1* of the Action Plan, see Annex A.

improvements from incremental, technical innovation are declining. Conversely, the competitive capabilities of European firms could increasingly depend on far-reaching productivity gains through "soft" parameters such as organisational innovation and human resource management, and on the exploitation of presentational innovation.

Table 1: Main European innovation policy themes

EU Green Paper 1995 Routes of Action	Lisbon Council Goals 2000 Objectives	Draft Action Plan 2005 Envisaged Actions
To develop technology monitoring and foresight	Coherence of innovation policies.	Innovation benchmarking and promoting excellence at European level.
To better direct research efforts towards innovation	A regulatory framework conducive to innovation.	Promoting technical regulations and standards that foster innovation.
To develop initial and further training	Encourage the creation and growth of innovative enterprises.	Make the most of intellectual property opportunities
To further the mobility of students and researchers	Improving key interfaces in the innovation system.	Enhance knowledge transfer and absorption.
To promote recognition of the benefits of innovation	A society open to innovation	Foster cross-border exchanges between clusters.
To improve the financing of innovation		R&D Framework Programme active for innovation.
To set up a fiscal regime beneficial to innovation		Reinforce the multi-annual programme's financial instruments.
To promote intellectual and industrial property		Reinforce cooperation with the European Investment Bank (EIB).
To simplify administrative procedures		Increase the impact on innovation of the Structural Funds.
A favourable legal and regulatory framework		Increase synergies between innovation and State aid policies.
To develop 'economic intelligence' actions		Identify, promote and simplify access to innovation professions and skills.
To encourage innovation in enterprises, especially SMEs, and strength the regional dimension of innovation		Rally Member States around the European model of innovation governance.
To update public action for innovation		

1. Most actions include national and community level perspectives.

Presentational innovations have little to do with technical innovation *per se*, but are powerful tools that enable firms to appropriate their investments in technical innovation by creating product differentiation. The interest in presentational innovation assumes that the identity that a product evokes and the images that are associated with it are both as important as its functionality to many consumers. Even in poorer economies, a brand such as Coca-Cola is capable of achieving rising market shares despite high costs due to its high presentational value. The inclusion of presentational innovation in the *Draft Action Plan* recognizes that the fundamental goal of innovation for firms is to increase profitability through higher levels of
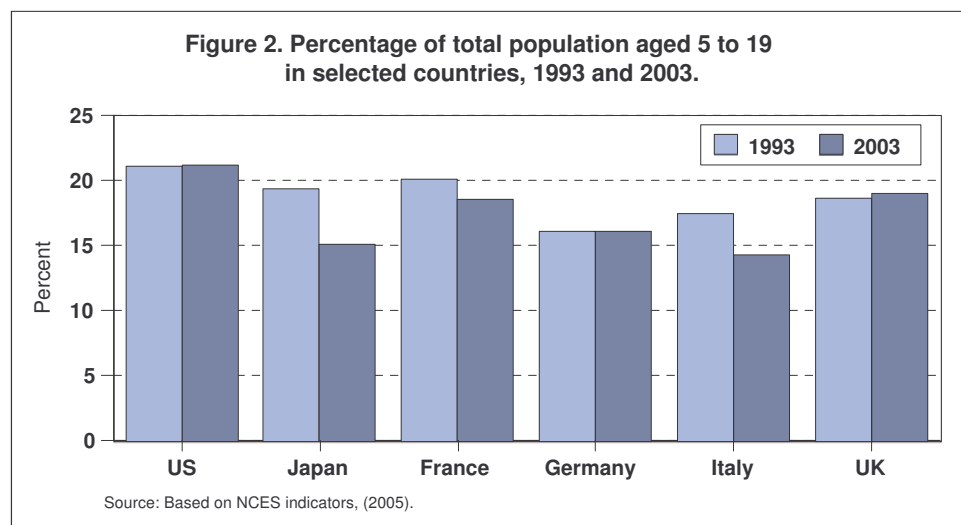
value-added that can come from either technical innovation, through a product's image[10], or through the combination of technical innovation with either organisational or presentational innovation.

2.2 Education Policy

In Europe, education is seen as a democratic good available to all. European education policy faces three major challenges due to 1) an increase in demand for tertiary education, 2) globalization, and 3) increased competition.

Increasing demand:

The demand for higher education is growing. The population share of the school-age cohort is stagnant or dropping in many countries in Europe and in the US and Japan (see Figure 2). However, this does not necessarily reduce pressure on education systems, as the share of adults pursuing education has increased from 22% in 1975 to 41% in 2000[11]. According to the OECD, half the adult population in the OECD countries, on average, enter tertiary education at some stage during their life. Of these 32% complete a first university-level degree. The range, however, is from less than 20% in Austria, the Czech Republic, Germany and Switzerland to 45% in Australia and Finland.

Figure 2. Percentage of total population aged 5 to 19 in selected countries, 1993 and 2003.

Source: Based on NCES indicators, (2005).

Increasing enrolment will create problems for European governments that fail to allocate adequate resources to tertiary education or which are reluctant to explore alternatives funding mechanisms. At the same time, universities operating in a KBE will be expected to improve efficiency through reorganization and more effective management.

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[10] A high profile based on brand recognition also creates risks, for instance if the brand is associated with poor labour or environmental practices. Potentially, this could lead firms, particularly large enterprises, to develop corporate social responsibility (CSR) strategies.

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Education systems will need to respond to changing economic and social conditions, such as a need for new sets of skills and life-long learning. The ability to respond in a timely fashion partly depends on the distribution of responsibilities among national, regional and local authorities. The OECD (2004) notes that the "most common goals (for changes in patterns of centralisation) are increased efficiency and improved financial control, reduction of bureaucracy, increased responsiveness to local communities, creative management of human resources, responsiveness potential for innovation, and creation of conditions that provide more incentives for improving the quality of schooling". The OECD carried out a survey to gauge if and to what extent responsibilities for lower secondary education in the public sector are being de-centralised or moving towards more centralisation. Among the countries surveyed[12], decisions were increasingly centralised in 2003 compared with 1998 in only a few countries: Germany, Belgium (Fr), Finland and Greece. The strongest trend towards centralisation of decision-making was in Greece where 25% more of the decisions in 2003 than in 1998 were under central government responsibility (OECD, 2004). The most notable among those who opted for decentralisation was Turkey, Korea and the Czech Republic, where more than one in three decisions were being made at a decentralised level in 2003 compared with five years earlier.

Globalization

The decline in the importance of distance combined with increasing demand is turning higher education into an 'export' industry, although the students are brought into the domestic educational system as high-fee paying students. A possible spin-off benefit is that the best foreign students can frequently be induced to stay, providing a remedy to the shortage of highly skilled people.

The 'export' potential of an education system depends on the quality of instruction, educational opportunities in the source country, and the ease of obtaining student visas. China has been working to increase educational opportunities at home, which is both reducing the number of Chinese seeking higher education abroad and attracting international students (together with Malaysia). The number of foreign students in China doubled between 1998 and 2002, reaching 86,000 students (OECD, 2004). This trend is comparable with a doubling of the total number of international students in the OECD over the last 20 years.

Competition

Greater human mobility creates competition for the best students, research grants, and staff. Europe is ahead on some indicators, while lagging on others. In 2000, there were 0.56 new S&T PhDs per 1000 population aged 25-34 in the EU-15, a continuance of a trend that began

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[11] Globaleducation.edna.edu.au, 2005.
[12] Nineteen countries were surveyed including Turkey, Korea, Czech Republic, England, Netherlands, Italy, Portugal, Denmark, Norway, Spain, Belgium(Fr), New Zealand, France, Austria, Germany, Hungary, Finland and Greece.

in the mid-1990s. The output of S&T PhDs in the EU-15 was consistently higher than that for the US and twice the share for Japan (see Figure 3).

Figure 3. New S&T PhDs per 1000 population aged 25-34 years, selected countries, 1996 to 2000.

Source: Based on Key Figures, 2002.
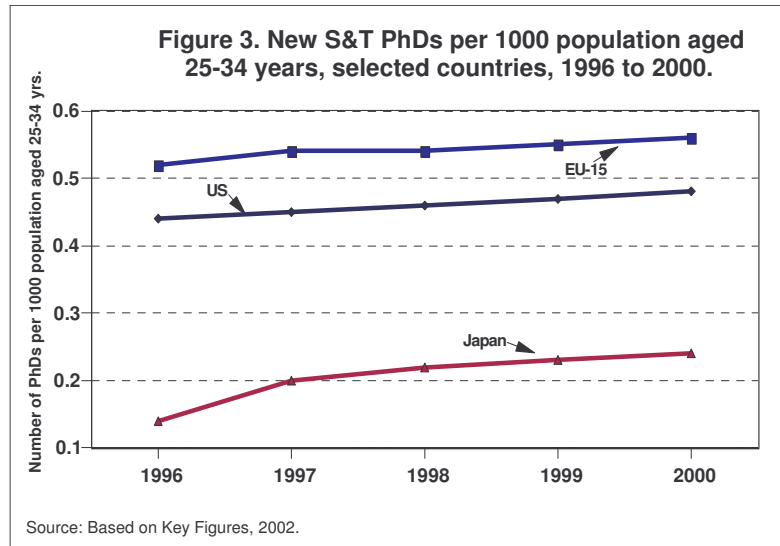
Other measures show that the European Union lags behind its competitors. Seventeen of the world's top twenty universities are in the United States. The United States also generates 70% of the world's Nobel-prize winners, 30% of the world's academic articles on science and engineering, and 44% of the most cited articles.[13] In 2000, the US produced 909 scientific publications per population compared with 803 for the EU-15 (S&T Indicators: Scoreboard, 2002).

China is currently expanding its universities at a speed well ahead of India, with enrolment numbers almost doubling in the year 1999. The number of undergraduates, as well as doctorates has been rapidly increasing, with the majority of doctorate degrees awarded in engineering, natural sciences and medicine (Wyckoff and Schaaper, 2005). In response to higher educational levels among competitors, several European countries have set goals to increase the output of tertiary-educated individuals.

EU policy response

The European Commission has been active in promoting skill upgrading to meet industry requirements, tertiary education standards and qualifications, and mobility of the highly-skilled.

Skill upgrading

The Centre for the Development of Vocational Training (CEDEFOP), established in Berlin in 1975 and transferred to Thessaloniki in 1995, is a European agency that helps promote and

develop vocational education and training in the EU. A current proposal is to introduce an integrated Credit System for Lifelong Learning, to be built on the ECTS[14] work on vocational education and training but extended to all methods of learning.

Educational standards and qualifications

In March 2002 in Barcelona, the European Council concluded that the European education and training system should become "*a world quality reference*", in line with the Lisbon strategy. The European Commission identified the following challenges and proposed several actions in May 2005 (EC, 2005) to strengthen European universities:

- Improve tertiary education attainment: Only 21% of the adult working population in the EU has a tertiary education, which is significantly lower than in the US (38%), Canada (43%) and South Korea (26%).

- Improve access to higher education: The percentage of European youth that attend some tertiary level institution is only 52% and is ahead only of Japan (49%). Canada (59%), the US (81%) and South Korea (82%) leave Europe lagging behind in an international comparison (OECD, 2004).

- Improve research performance: Although European universities produce more S&T graduates and more PhD's overall than other countries; only 5.5 per 1,000 employees go into research. Canada and South Korea are in similar situations, but the rates are much higher in the US and Japan, at 9.0 and 9.7 researchers per 1,000 employees.

Several actions have been proposed to reach these goals (EC, 2005). In order to provide quality assurance for tertiary degrees, the Commission suggests adopting minimum compatibility standards. These would apply to both Universities and to qualifications. The latter would require cross-recognition of qualifications, in line with a proposal of the Commission in 2004 on accreditation[15]. Qualifications could also be extended to provide common reference levels for learning outcomes ranging from basic skills to doctorates; that is the actual skills and competences acquired. This intention is to facilitate mobility and make degrees more comprehensible to employers. The European Qualifications Framework will be based on consultations and should be complete by 2006.

Another proposal is to introduce a *European* Doctorate, to be awarded to doctoral programmes with a 'clear European Dimension', with the purpose of encouraging joint education and research.

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[13] These numbers are according to the globally used ranking by Shanghai Jiao Tong University.

[14] ECTS guarantees academic recognition of studies abroad by providing a way of measuring and comparing the student's learning achievements, and transferring them from one institution to another: credits, which reflect the quantity of work, and grades, which represent the quality of work.

[15] EUR-ACE-Accreditation of European Engineering Programmes and Graduates.

The development of the Bologna process, stemming from the Bologna declaration of June 1999[16], indicates that policy makers have identified the main challenges of the future. The combination of increased transparency and enhanced mobility in the six proposed actions is likely to promote increased competition among universities, with the objective to make the higher education systems in Europe more transparent and based on a common degree framework of Bachelors, Masters and Doctorate degrees.

In Berlin in 2004, Europe's Ministers of Education decided to speed up the process of creating comparable university qualifications by setting three short-term targets for all signatory countries to be fulfilled by 2005[17]. These targets are 1) the adoption of a two-degree system (Bachelors and Masters) to replace a single degree systems (Masters only), 2) the automatic issuance of a diploma supplement in one of the EU's main languages to all graduates free of charge, and 3) to have made a start on introducing a quality assurance system. They also decided to closer links between the European higher education area and the European research area, by agreeing that the doctorate cycle will also be covered by the Bologna reforms.

Mobility

The Erasmus initiative - a university student international exchange program, began in 1987 to encourage young people to study in other European countries. Over one million students have taken advantage of this programme.[18]

Drawbacks

It is not merely the supply of technically trained personnel that matter, but the match between industry requirements and the output of the higher education system. A perfect match is an unachievable goal due to the impossibility of forecasting future demand. However, some of the European Commission's proposed reforms fail to address the requirements of the private sector and instead reflect political conditions. One example is the European Commission's proposal for European universities to require fluency in three languages (EC, 1995), which is unlikely to be a relevant requirement for firms seeking scientists and engineers. Another

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[16] The Bologna Declaration, signed in 1999, is intended to produce a single European area of higher education by 201016, by introducing six actions in a combination of comparable qualifications and transferable credits such as:
1. a system of academic grades which are easy to read and compare;
2. a system essentially based on two cycles : a first cycle geared to the employment market and lasting at least three years and a second cycle (Master) conditional upon the completion of the first cycle;
3. a system of accumulation and transfer of credits (of the ECTS type already used successfully under Socrates-Erasmus);
4. mobility of students, teachers and researchers;
5. cooperation with regard to quality assurance;
6. the European dimension of higher education.

[17] http://europa.eu.int/comm/education/policies/educ/bologna/bologna_en.html

[18] http://europa.eu.int/comm/education/programmes/socrates/erasmus/erasmus_en.html

example is the failure of the Commission to ensure that professional diplomas are transferable among EU member states.

2.3 ICT Policy

The European policy level can help by defining the framework conditions for ICT and e-business development, among other things through knowledge sharing. In order for this to happen, issues such as IPR protection need to be resolved. Examples of European policies for knowledge diffusion and exchanges on ICT are the incubator forum Technology Incubator Managers, Academic Network (Innovative companies seeking expert service providers), Proton Europe (Knowledge Transfer Offices), InvestorNet (for investors in ICT) and the pan-European Business Platform Gate2Growth. The Commission is planning a new initiative INNOVA, which will encompass innovation-financing networks, standards and innovation and cluster networks at a sectoral level.

E-government provides a method for implementing more democratic governance in Europe and for increasing the transparency of public services. Within the European context, the latter is more likely to be used than direct government. The European Commission's perspective on e-government emphasizes the use of ICT in public services and the importance of equal access, transparency and accountability. The aim of European e-government is to provide World-class public administrations as a tool for pursuing the Lisbon strategy. This includes a roadmap towards widespread e-government in Europe through a Best Practice Framework aimed at realizing more benefits in Europe, and to strengthen innovation[19].

3. OECD and US Perspectives on KBE Policy

Section 2 provided an overview of the main European policies of relevance to a KBE. This section briefly highlights the OECD and American policy responses to the five main characteristics of a KBE.

3.1 The OECD Perspective

Most European national governments use the OECD's findings as a benchmark, as a tool for peer review, and to identify good practices. The OECD report *The New Economy: Beyond the Hype* offers a large set of policy recommendations for the KBE, which constitutes the consensus view of OECD countries that will be followed by most governments. The recommendations fall into five categories:

1. To promote ICT

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[19] Paul Timmers, Head of Unit eGovernment, Directorate General Information Society.

2. To improve the innovation climate
3. To enhance human capital
4. To promote entrepreneurship and start-ups
5. To strengthen economic and social fundamentals

The fifth recommendation, to strengthen economic and social fundamentals, apply equally to all modern economies and contain little that is specifically relevant to a KBE. For this reason, these recommendations are not covered below[20].

Promote ICT
The OECD stresses the importance of policy efforts to increase the use of ICT rather than the creation of an ICT manufacturing sector, which is costly and not necessarily a driver for economic growth. What counts more is how ICT is used to improve productivity and innovation. Methods to promote ICT include:

- Increase competition and continue with regulatory reform in the telecommunications industry to enhance the uptake of ICT.
- Ensure sufficient competition in hardware and software to lower costs. This can be promoted through effective competition policy frameworks, lower barriers to international trade and investment, and national and international IPR regimes.
- Build confidence in the use of ICT for business and consumers. This involves flexible regulatory frameworks for privacy, security and consumer protection.
- Make e-government a priority. ICT can help government to become more efficient.

Improve the innovation climate
The OECD suggests five general policies to improve the innovation climate. First, governments should give greater priority to funding basic research, the foundation for future innovation. Second, the effectiveness of government funding for innovation should be improved by focusing on areas with high economic or social benefits. In this respect, the OECD supports public-private partnerships (PPP) to share costs and increase the leverage of government funding. Third, governments should make greater use of competitive funding and evaluation in supporting public research. Support for institutions remains important, but competitive funding instruments and strong evaluation procedures are needed to improve the quality of research and focus on the areas of greatest value. Fourth, governments should ensure that IPR regimes governing publicly funded research strike a balance between the diffusion of knowledge across research institutions and its application by the private sector. Striking this balance will require international co-operation. Fifth, remove barriers and regulations that limit effective interaction between universities, firms and public laboratories. One goal is to improve the flow of knowledge and workers between science and industry.

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[20] They include preserve macroeconomic stability, maintain openness to trade and competition, mobilize labour resources, and address the redistributive implications of structural change.

Human capital

The OECD recognizes human capital as a key component of a KBE. It provides six recommendations, most of which are similar to current EU policies. The first is to Invest in high-quality early education and childcare, which are more cost-effective than later interventions. Second, Governments should work to improve completion rates for basic and vocational education by reducing dropout rates and improving ICT and reading literacy. This will require recruiting qualified teachers and making pay more competitive. Third, improve the school-to-work transition through mechanisms such as combining education with workplace experience and by establishing co-financing between employers, trainees and government. Fourth, strengthen the links between higher education and the labour market through developing shorter course cycles with a healthy orientation to job market requirements. Fifth, provide wider training opportunities, particularly for adults and workers to participate in higher education. Innovative instruments, such as individual learning accounts and systems of recognition of competencies, could enhance incentives to engage in training while helping to control costs. Sixth, reduce obstacles to workplace changes and give workers a greater voice, since employee involvement and effective labour-management relationships can raise productivity. Similarly, working time legislation and employment regulations should not impede organizational change.

Promote entrepreneurship

The OECD makes four recommendations to promote entrepreneurship. The first is to promote access to financing by reforming: regulations and fiscal provisions that inhibit the development of venture and high-risk capital markets and limit the supply of capital for risky and innovative undertakings. Second, regulatory impediments to firm entry and exit should be minimized. These include burdensome administrative regulations and features of tax systems that afflict small, technologically driven, young firms. Third, all policies should be regularly reviewed to prevent the accretion of programmes that can hamper firm growth or slow the exit of noncompetitive firms. Finally, the OECD recommends encouraging an entrepreneurial spirit in society through education and provision of managerial training.

Table 2 maps the policies proposed or in place within the EU, the OECD, and the United States against the five main characteristics of a KBE.

Table 2. Mapping the five main characteristics or drivers of a KBE and selected policies focuses.

KBE characteristics	EU	OECD	US
Influence of ICT production and diffusion	• Lisbon strategy: options for the information society includes steps to encourage the adoption of ICT, such as e-commerce and mobile communications.	• Focus policy efforts on increasing the use of ICT, rather than its production • Increase competition and continue with regulatory reform in the telcom industry to enhance the uptake of ICT.	• E-government initiative • Advocate U.S. standards in global markets • Increase access across the country – address access problems in rural communities and households (e.g. low income) • Increase use of IT in small businesses
Human resources	• The goals for education and human capital include halving the number of school leavers, adapting education and training to the needs of a KBE, promoting lifelong learning, and support for greater mobility, particularly among highly skilled individuals. • European Council: improve national strategies for lifelong learning (in part to address an ageing population), and greater support for entrepreneurship, among other recommendations.	• Invest in high-quality early education and child care • Raise completion of basic education and improve the quality of the system. • Improve school-to-work transition. • Strengthen the links between higher education and the labour market in a cost-effective way. • Provide wider training-opportunities for adults and workers. • Reduce obstacles to workplace changes and give workers a greater voice.	• Increase funding for colleges for training workers that are in demand. • Encourage SMEs to use ICT for flexible and low cost training • Permits for bringing in highly skilled scientists, engineers and management – H-1B and intra-company transfers are two mechanisms that help foreign sources quickly fill labour demands. • Make sure children are 'not left behind' – improve primary and secondary school attendance – raise level of education of children and interest in education. • Improve student achievement, create a culture of achievement in schools rather than culture of compliance.
Quantitative and qualitative change in knowledge production	• Creation of an 'European Research Area' through strengthened links between researchers across Europe. • Make Europe more attractive for the best researchers by increasing spending on R&D, support for research into new technologies, reduce administrative obstacles, fast track work and visa procedures for researchers, and improve recognition of professional qualifications. • Offset assumed negative effects of a brain drain from Europe to the United States with an increase in non-EU immigration.	• Give greater priority to fundamental research; future innovation will be jeopardized without it. • Improve the effectiveness of government funding for R&D. • Make greater use of competitive funding and evaluation in supporting public research. • Tackle new challenges in intellectual property regimes. • Remove barriers and regulations that limit effective interaction between universities, firms and public laboratories.	• Promote opportunities for US companies abroad (e.g. IT companies) • Establish regional competitiveness to stimulate economic development • Coordinate and consolidate workforce development programs with economic development initiatives – make sure both going in same direction to meet growth needs. • Provide additional funding to train workers for jobs in industries that are creating jobs • Increase federal R&D funding

KBE characteristics	EU	OECD	US
Greater levels of entrepreneurship and creative destruction	• Improve bankruptcy regulation, facilitate access to low cost finance, and to reduce the cost, time and effort needed to set up a business to support entrepreneurship. • The creation of an independent European Research Council to fund and coordinate long-term basic research	• Promote access to financing. • Facilitate firm entry and exit. • Review and assess the relevance and effectiveness of government support programmes.	• Increase use of IT in small businesses • US is taking steps to make government 'friendlier' to small businesses • Small Business Administration set up to help business (aid, counsel) • Set up offices for women entrepreneurs • Promoting venture captital by facilitating access to private capital (e.g. loan guarantees) • Web site business gateway
Structural change — organisational innovation and internationalisation of production and knowledge generation	• Creation of a 'European Research Area' through strengthened links between researchers across Europe. • Internationalisation of knowledge generation seen as a competitive threat. • No policies for organisational innovation, but promoting measurement of this type of innovation in the Community Innovation Survey as a first step.	• Supports open flow of science across borders as a general principle. • Recognizes importance of organisational innovation but no policies.	• Internationalisation of knowledge generation seen as a competitive threat. • Minimal attention to organisational innovation.

3.2 The US perspective

This section briefly identifies some of the key policies and initiatives underway in the U.S. for the growth and prosperity in the KBE.

The Department of Commerce is a key department for economic and business policy in the U.S. It is charged with "creating the conditions for economic growth and opportunity for promoting innovation, entrepreneurship, competitiveness and stewardship" (Strategic Plan FY2004 to FY2009) and aims to promote growth and employment. It played a lead role in driving the agendas of the G8 and OECD discussions on the Information Society/Information Highway and the OECD's *Economics of an Information Society* in the 1990s. The Department continues to play a key policy role both nationally and internationally, and works with U.S. businesses to promote jobs and growth. Its current FY2004 to FY2009 strategic work plan *American Jobs, American Values* identifies three main strategic goals, summarized in Table 3.

Table 3. Strategic Goals of the US Department of Commerce

1. Provide the information and tools to maximize U.S. competitiveness and enable economic growth for American industries, workers and consumers:	• Enhance economic growth for all Americans by developing partnerships with private sector and nongovernmental organizations. • Advance responsible growth and trade while protecting American security. • Enhance the supply of key economic and demographic data to support effective decision-making of policy makers, businesses and the American public.
2. Foster science and technological leadership by protecting intellectual property, enhancing technical standards, and advancing the measurement of science:	• Develop tools and capabilities that improve the productivity, quality, dissemination and efficiency of research. • Protect intellectual property and improve the patent and trademark system. • Advance the development of global e-commerce and enhanced telecommunications, and information services.
3. Observe, protect and manage the Earth's resources to promote environmental stewardship:	• Advance understanding and predict changes in the Earth's environment to meet America's economic, social and environmental needs. • Enhance the conservation and management of coastal and marine resources to meet America's economic, social and environmental needs.

Source: Strategic Work Plan, Department of Commerce.

Policies to promote ICT

A study by the Department of Commerce, *A Nation Online: Entering the Broadband Age,*[21] measured the types of activities that Americans engage in on the internet and their use of broadband technologies. The strongest growth between 2001 and 2003 was in e-commerce (e.g. purchases of goods and services on-line). The share of Americans engaged in e-commerce grew by 8% between 2001 and 2003 and the share that engaged in online banking grew by 10%. One challenge for policy is that the tendency to engage in certain internet activities is linked to the location of internet access (e.g. available in the home or at work) and the mode of access (broadband, telephone dialup, etc). The results of the study also show that rural households continue to suffer from a lack of broadband access compared with urban households and this could limit the potential for economic growth using the internet and benefits to citizens (e.g. on-line training courses or access to information). Table 4 shows that three quarters of rural households in 2003 accessed the internet with dial-up.

Table 4. Percent of households with internet by type of connection, US, 2003.

	Total	Rural	Urban	Central city
Dial-up	62.8	74.7	58.9	58.4
Cable modem	20.6	14.3	22.6	21.1
DSL	15.2	9.2	17.2	19.1
Satellite and fixed wireless	0.7	1.2	0.6	0.7
Other	0.8	0.7	0.8	0.8

Source: *A Nation Online: Entering the Broadband Age,* p.13.

Access to the internet for citizens outside of urban centres will continue to be a challenge for the policy goal of access for all.

Another policy priority is the advancement of ICT and telecommunication technologies. This will be done by negotiating the allocation of adequate spectrum resources for current and future technologies (e.g. with the ITU) and advocating the acceptance of standards including U.S. standards so that global markets can choose the best (Department of Commerce). The ability to make use of ICTs to protect national security and to cooperate with agencies and organizations both within the US and outside the US, and to prevent the misuse and abuse of these technologies, are other key policy goals of the current strategic plan.

Although internet usage in the U.S. has grown by leaps and bounds, one segment that shows less than expected growth is small business. An OECD study (2005) reports that e-commerce is uneven among small businesses: nearly all small businesses have

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[21] The study covered internet activities such as communications (e.g. e-mail), entertainment (e.g. video gaming), transactions (e.g. banking on-line) and information (e.g. searching for information about weather, government services etc),

computers but only 40% of them use them for business purposes; most small businesses use the technologies for e-mail rather than for taking orders online. The government is committed to the view that e-commerce is a driver for growth in exports and international markets and it has developed a number of 'outreach' programmes for small businesses that include services such as on-line market research and seminars on e-commerce topics. An example of small business tools can be viewed at www.export.gove/infotech.

The promotion of ICT is inherent to strengthen economic and social fundamentals. Table 5 presents recent figures that show trends on unequal realization of the full benefits of ICT for different groups of citizens. For example, the lower the family income, the less likely individuals are to use the internet. The lower the educational attainment, the lower the internet usage and the older individuals are, the less likely they are to use to the internet (Table 5).

Table 5. Internet use (any location e.g. work or home or elsewhere) by the population aged 3 years of age and older, U.S. 2001 and 2003.

	Percent who are internet users	
	Sept. 2001	**Oct. 2003**
Total population	55.1	58.7
Gender		
Men	55.2	58.2
Women	55.0	59.2
Employment status		
Employed	66.6	70.7
Unemployed and/or not in the labour force	38.0	42.8
Educational attainment		
Less than high school	13.7	15.5
High school diploma	41.4	44.5
Some college	63.5	68.6
Bachelor degree	82.2	84.9
Above bachelor degree	85.0	88.0
Age group		
Age 18-24	66.6	70.6
In school	85.4	86.7
Not in school	54.0	58.2
Age 25-49	65.0	68.0
In labour force	68.4	71.7
Not in labour force	47.1	49.7
Age 50+	38.3	44.8
In labour force	58.0	64.4
Not in labour force	22.2	27.6

Source: *A Nation Online: Entering the Broadband Age,* A-1.

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The information on internet usage such as that shown on the preceding table has important implications for government policy — people who may have great benefit and need from the internet are not accessing the services (e.g. e-government services and education and training for groups of lower educated, disabled and elderly) as much as other groups. The problem of exclusion of groups of society in a KBE remains a challenge for policy makers in many countries.

A Presidential Committee (President's Information Technology Advisory Committee) has been established to advise on development and maintenance of a "multi-decade roadmap for computation science R&D investments" (PITAC Report to the President, June 2005). PITAC is in charge of overseeing the Networking and Information Technology Research and Development Program that was established to formulate and promote IT R&D. It coordinates IT policy development across agencies and departments and enforces a horizontal and informative policy process for IT. It also promotes cooperation between R&D organizations in the public, university and private sector. PITAC produces reports on the critical challenges for IT that government policy decision makers may face.

Policies to improve the innovation climate

The U.S. government plays an active role in promoting opportunities for U.S. ICT and telecommunication companies (Department of State). It does this by negotiating for open foreign markets, ensuring fair competition, and by helping to resolve regulatory, trade and technical issues with foreign governments.

According to the Department of State, the economy has changed in the KBE but policy continues to react much as it did within the earlier economic structure. In February 2005, the *Strengthening America's Communities* Committee was established to provide advice and recommendations on how federal policy can assist communities to compete in a KBE. Below is a summary of the key policy recommendations:

- *Establish regional competitiveness as the overriding goal for federal economic and community development policy.*

- *Review all federal policies and regulations for their impacts on the sustainability and competitiveness of economic regions.*

- *Require long-term, innovation-based, regional economic and community development strategies as a prerequisite for follow-on federal assistance.*

- *Provide significant funding of technical assistance to regions for the formulation of innovation-based regional economic development strategies.*

- *Coordinate and consolidate workforce development programs with economic development initiatives to drive innovation-based economic growth.*

- *Direct federal economic and community development resources to encourage communities to form regional partnerships and governance models primarily based on economic relationships, not political boundaries.*

- *Promote private-public partnerships for regional development that include educational and research institutions, national laboratories, labour organizations, private businesses, and government, which collaborate and co-invest as partners in regional competitiveness.*

All of these policy steps are designed to ensure that "the United States has a pro-business culture that encourages risk taking and innovation, rewards success, and provides for the ability to recover form business failure" (OECD, 2005).[22]

As part of specific actions to ensure that innovation grows and flourishes, a number of policies have been introduced to make sure that workers have the best training and tools and that living conditions improve. Below are some of the policy initiatives:

- Training — proposed $250 million to help colleges train an additional 100,000 workers for industries creating the most new jobs; doubling the number of workers receiving federal job training assistance.

- Health care — improve health care quality; reduce costs; improve administrative efficiencies; IT innovations for medical records and secure information exchange.

- High speed access — universal affordable broadband by the year 2007.

- Energy — competitive process to fund new hydrogen research projects and includes awards for academia, industry and public laboratories: encourage labs, automakers and energy companies to work together for integrated technology solutions.

The plan to increase federal R&D funding in FY 2005 increased R&D intensity to the highest level of GDP in over ten years (A New Generation of American Innovation).

Federal and state governments work to help small businesses access innovation and technology through:

- The Manufacturing Extension Partnership provides advice on productivity, quality control techniques and product design (federal)

- Facilitating the diffusion of technology to farmers through the use of a widespread system of extension services (federal and state level).

- Diverse approaches at the state level from business incubators to private sector partnerships with state universities and venture capital (OECD, 2005).

Policies to enhance human resources

In the U.S., small businesses have access to technical assistance programmes that include training and mentoring through the U.S. Small Business Administration and various private sector partners (OECD, 2005). ICTs are used to encourage SMEs to make use of low cost and flexible training methods. The Small Business Administration provides grants to support sector managed networks of Small Business

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[22] In April 2004, there was a new set of measures to promote innovation in the U.S. announced by the President. The government must facilitate (e.g. political and economic climate where innovation can thrive) and help create a new generation of innovation (The White House, Press Release, April 2004).

Development Centres (there are some 1,100) and the Small Business Training Network offers free on-line courses. At the local and state level, governments provide funding for community colleges located in (or near) the communities in which the businesses carry out their activities to ensure the small business work force can increase skill sets and get training for job needs and career advancement.

The U.S. has a tradition of successfully drawing upon foreign-born talent. Immigration policy is designed to respond quickly to market demands for scientists, engineers and technical personnel. The H1-B visa is used by employers to import highly skilled temporary workers. The minimum requirement is a Bachelor degree and the typical occupations are in social sciences, natural sciences and engineering and health and education. There is an annual limit, but upper limits are changed as market demands vary. This is the visa that allowed the U.S. to rapidly import IT talent when world demand for people with these skills was on the rise. For employers in some countries, it can take weeks or even months to bring in foreign scientists and engineers while U.S. policy can provide for a very short turnaround time[23]. In 2004, 29% of the foreign temporary workers entered the U.S. under the H-1B visa. As well as the H-1B, many foreigners enter the U.S. on intra-company transfers (in 2004, 24% of the foreign temporary workers) and the impact of this cohort has yet to be fully analysed.

Policies to promote entrepreneurship and start-ups

In the U.S., more than half of the firms in the goods-producing industries and just about half of the firms in the services-producing industries are small businesses (OECD, 2005). Small businesses are one of the key producers in the economy and they are also the ones that may run awry of the regulatory environment and have limited resources to deal with various government departments and their regulations.

The U.S. has a pro small business policy. To try to minimize small business problems with government rules and regulations, the Regulatory Flexibility Act (RFA) was put in place (1980) so that various agencies have to consider the impact (and associated costs) of rules and regulations on small businesses. The federal government continues to push for RFA compliance and in FY2003, the OECD estimates that 6.3 billion USD were saved in regulatory costs and there were more than 5.7 billion USD in annual savings to small businesses through the continuing efforts of federal agencies.

The Small Business Administration (SBA) is the principal instrument for small business policies and exists solely to aid, counsel and protect the interests of U.S. small businesses. State and federal governments work together to make life easier for small businesses. There are extensive networks to help small businesses establish and flourish as well as to help improve management skills.

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[23] Under the current regulation, the H-1B has a maximum of six years. After six years the foreign worker must be out of the U.S. for one year before another visa can be approved (some exceptions apply).

The U.S. has set up two federal offices that focus specifically on women's entrepreneurship and this is unique among the OECD countries. This may be part of the reason the U.S. has enjoyed a significant increase in the number of SMEs owned by women. An OECD study estimates that 30% of the firms in the U.S. (6.7 million) are majority owned by women. This dedicated attention to women entrepreneurs is a win-win situation: it increases the number of small businesses and is successfully tapping the contribution of women for economic growth and job creation.

The U.S. government plays a role in venture capital through the Small Business Investment Company (SBIC), a public-private partnership to encourage access to private funds by providing guarantees by the Small Business Administration. This provides a much larger base for start-ups and growth stages. It also provides a bridge between traditional financing sources and the needs of small businesses for capital.

As part of its e-government initiative, the federal government has launched a website to serve as a business gateway for U.S. businesses to connect with federal agencies including business tools and resources. It is a 'one stop' shop for businesses (White House Press Release, May 21, 2004). This site links to business development (e.g. information on starting and managing a business), financial assistance options, taxes, laws and regulations, international trade, workplace issues, buying and selling (e.g. doing business with the government) and federal forms.

Policies to strengthen economic and social fundamentals
The 2006 Budget has a proposal for a new initiative to bring together a number of existing programmes to simplify access to the Federal system for community assistance. "The new $3.71 billion unified grant-making program will better target assistance and achieve greater results for low-income persons and economically-distressed areas" (US Department of Commerce, 2005). This will include developing new eligibility and allocation criteria, developing new competitive challenge grants. The goal is to shift from economic development assistance to results-oriented, competitive grants. The plan is to phase everything in over a ten-year period.

Another goal of the federal government is to promote access to and expansion of ICT and telecommunications to the benefit of education, health and welfare, both in the U.S. and around the world (US Department of State). This includes cooperation with international agencies such as the UN and the ITU and the efforts to eliminate unnecessary regulations overseas and to support the privatization of state-owned firms.

The 2002-2007 strategic plan of the Department of Education includes what is described as the "most fundamental reform of federal education policy in over 35 years: the *No Child Left Behind Act"*. (US Department of Education, Strategic Plan, March 2002). The plan is to ensure that American children have better access to education. Elementary and secondary education is to be improved and all children have to have a chance to progress through the education system. This is a major

challenge for the US. The plan is to increase student achievement and build "character and citizenship in youth". This is an expensive endeavour for governments (federal and state) — in order to increase participation and boost achievement scores, investment will be needed in forms of infrastructure (e.g. new schools and new tools for new knowledge). Another goal of the plan is to "change the culture of the education system…from one of compliance to a culture of achievement, professionalism and results". This policy development then has six goals as outlined in the Strategic Plan:

1. Create a culture of achievement
2. Improve student achievement
3. Develop safe schools and strong character
4. Transform education into an evidence-based field
5. Enhance the quality of and access to postsecondary and adult education
6. Establish management excellence.

For each of the key activities, a series of performance measures are in place. And, just as with some of the other strategic plans described above, collaboration among government agencies is emphasized. For example, working with the National Science Foundation will help improve mathematics and science instruction and hopefully encourage more youth to be interested in pursuing further studies in mathematics and science.

Policies for e-government

In 2002, President Bush signed into law the 'E-Government Act of 2002', legislation intended to establish a comprehensive framework for information and security standards for government services. Key elements include: codification of expanding government initiatives, sponsoring ongoing dialogues with governments (various levels) as well as the general public, the private and non-profit sectors to find innovative ways to improve the performance of governments in collaborating and using information technology to improve the delivery of government information and services (E-gov, 2005).

While some governments are considering e-government as a way of putting forms in another format (see WP 1.1), the U.S. is intent on using the technology to provide services and information to citizens. E-government has the potential to make government more transparent and according to a survey carried out by the Pew Foundation for the President's E-government Strategy (Powering America's Future with Technology, 2005), more than 40 million Americans went on-line to look at government policies and over 20 million used the internet to send their views to the government.

As part of its e-government initiative, there are e-government benefits that offer citizens access to available federal and state benefits. More than a site for forms, it is a citizen-centred one-stop shop that assists visitors with their unique needs (Press

release, April 29, 2004). This is a demonstration of government cooperating through the technologies and efforts to streamline activities: it represents the collaborative efforts of 10 federal agencies.

One of the strengths of current U.S. policy is the determination to advance policy through horizontal cooperation. This is evident in many of the key policy departments' strategies, action plans and outcome measures. The activities and initiatives briefly covered above describe a federal government that is consolidating and repositioning itself for a KBE.

4. The National Policy Context within Europe

4.1 Introduction

The evolution of national policies has varied in coherence and focus. In the 1980s, national innovation policies often focused on supporting a few innovative leaders or 'national champions' via direct economic subsidies for research and development (R&D). During the 1990s, innovation policies in many EU countries shifted in response to three factors: (1) the need to reduce direct R&D subsidies to firms both for budgetary reasons and to satisfy European competition policy, (2) the adoption of evolutionary theories and system views of the innovation process and (3) the widespread conviction that European firms failed to translate European strengths in basic research into economically successful innovations (the European 'paradox').

The NIS perspective encouraged member states to establish framework conditions to support innovation and to reduce innovation subsidies for the private sector that were targeted towards strategic technologies such as information and communication technologies (ICT) or biotechnology. Consequently, the trend in countries such as the Netherlands, the UK and Denmark was towards innovation programmes that did not favour specific technologies. This trend, however, conflicted with the goal of increasing the commercial applications of public sector research. Commercialization has been supported in some states through the use of forecasting techniques to target funding for public research towards technologies with commercial applications.

From the late 1990s until 2003, KBE policy in many EU countries has gone through a period of readjustment to bring policies for the private and public sectors into alignment. This was partly met through increasing support for technology-specific networks and clusters and through a concerted effort in many EU countries to increase linkages between the public research sector and private firms.

In this chapter, we first review national level policies of relevance to each of the five main characteristics of a KBE. The intention here is to cover the major types of policies available at the national level. It is not possible to summarize all policies,

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many of which are only in place in one or two countries. A major source for the identification of relevant national policies is the Trend Chart website. Although Trend Chart focuses on policies of relevance to innovation, the coverage is relatively broad and also covers national programmes on education or the e-economy. The final section of this chapter explores a key issue of relevance to KBE policies: do countries share similar national innovation systems? If yes, and we think they do, the policy community can possibly benefit from borrowing successful policies that are already in place within a similar NIS. Conversely, borrowing policies from countries with a very different NIS might be less successful, since it will be less adapted to national conditions.

4.2 National KBE Policies

The discussion of KBE policies is structured after the five main characteristics, or drivers, of a KBE. No attempt is made to provide a comprehensive overview of all relevant policies for each of the 25 EU member states. Instead, each section describes some of the main types of policies that are currently in use within the EU.

4.2.1 ICT investment and use

ICT policies have evolved over the last decade from policies to promote the adoption of IT to more nuanced policies, including the support of internet related activities. ICT is increasingly seen as a driver for innovation not only in operations, but for organizational innovation (Marwah et al., 2003). As an example, e-business provides a pathway to innovation and productivity improvements by providing new ways of doing business. It also creates new opportunities in presentational innovation. In this context, e-business can be one of many ways of increasing competitiveness, and should therefore be linked to other innovation policies.

Only the Scandinavian countries currently have integrated policies to promote e-business. Although innovations in e-business can both improve the outputs of the RTD process and provide a tool for investment and modernization of SMEs, most European countries distinguish between these two aspects of innovation. The result is two different policy sets, typically dealt with by two different ministries; Ministries of Education on the one hand and Economic Ministries on the other (Allison et al., 2005). In Luxemburg, innovation policy is embedded in the national development plan, with 12 'Innovation Platforms incorporated into the strategy. Eight of the 12 platforms are related to ICT.

Several national governments have implemented programmes to encourage SMEs to introduce e-commerce or otherwise develop internet skills. These have been used in the past in Germany, Italy, France (PAGSI) and Greece.

4.2.2 Human Resources

Most Europe countries are currently trying out different solutions to funding an increasingly crowded public tertiary education sector. National governments face the dilemma of either restricting access or increasing funding. Restricting access to S&E programmes will conflict with European goals to increase R&D levels and competitiveness within a KBE. The alternative is to develop new ways of funding tertiary education, such as through student fees, the forging of partnerships with private enterprises, or by improving efficiency through promoting mergers between universities[24]. The result of the current trends might be a new European educational structure with a few elite research institutions and a range of more specialized ones. However, policies on higher education differ among the European countries.

Finland and Sweden are among the countries that allocate adequate public resources to the higher education sector, a fact that partly explains the high research output of universities in these countries[25]. The Scandinavian countries have a long tradition of investing in education. As a result most research is being done within universities. Education is free for all citizens in Sweden, Finland and Germany, traditionally funded by the state. With growing enrolment rates, all three countries need to increase funds for tertiary education. Sweden and Finland are providing public funds to match this growth in higher education and research.

Germany currently does not charge tuition for either domestic or foreign students. It is looking at alternative sources of funding, mostly by way of charging tuition. Germany has fallen behind in the higher education rankings[26], due partly to a lack of building maintenance, over-crowded lectures halls (The Economist Higher Education Survey 2005), and a decline since 1960 in the number of Nobel prize-winners based at German universities[27]. Partly as a result of the exploration of alternative revenues streams, Germany is also seeing the emergence of 'elite schools' that attract the best resources and students.

Four main policy initiatives are in use in the EU-25 to improve human resources: life-long learning programmes, methods to increase the domestic supply of scientists and engineers, immigration policies to attract highly skilled immigrants, and support for post-docs. The following four sections give examples of the range of relevant human resource policies currently in use within the EU.[28]

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[24] Possibly misguided, with no evidence to show that academic output increases with the size of universities.
[25] OECD Science and Innovation Policy – Key Challenges and Opportunities, 2004.
[26] See for example Shanghai Jiao Tong University's ranking of World Universities at http://ed.sjtu.edu.cn/ranking.htm.
[27] Nobel laureates. http://www.nobel.se.

Life-long learning initiatives

To remain competitive in the current economic climate, constant upgrading of skills is necessary, and knowledge acquired through the completion of formal education do not suffice to create a innovative labour force, as qualifications become obsolete or as new technologies that require new skills are introduced. As a consequence, countries such as Germany Greece, Hungary, Italy, Lithuania and Slovakia could jeopardise the future quality of their human capital by under-investment in lifelong learning (Trend Chart, 2005). According to the same line of reasoning, as innovative economies reward flexible skills rather than static knowledge, countries that are relatively weak in tertiary education output could partially overcome this weakness with on-the-job training programs and life long learning policies.

The French educational reform (LMD) provides a comprehensive approach to the challenge of life long learning. The Austrian University Act of 2002, in force since January 1, 2004, gives universities greater autonomy in order to better respond to changing demands for qualifications and skills. Italy is particularly weak in life-long learning, with its policy innovation measures remaining focused on process innovation, with an emphasis on cost-cutting.

Poland, as with many other new member states, needs to strengthen life-long learning in order to be able to use new technology. A structural education reform was underway in 2004, as well as a strategy for life-long learning through the 'Programme for Human Resource Development'. In Slovakia, the Sectoral Operational Programme on Human Resources (SOPHR) provides for greater investment in lifelong learning to help adapt vocational training and education to the needs of the knowledge-based society.

Tertiary graduates in Portugal and Malta are a small part of their respective working populations. In Malta, this weakness is addressed by the University of Malta through annual 'Graduate Potential Seminars' that discuss labour market developments and needs. Portugal, however, ranks well below many of the new EU member states in life long learning and shows no signs of catching up, despite several government initiatives on education and vocational training, although they still need to be approved and implemented.

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[28] The policy examples are drawn from the TrendChart report *Innovation Policy in Europe 2004*.

Increasing the supply of scientists and engineers

A common perspective is that the knowledge economy requires an increase in the supply of scientists and engineers. In Germany, Ireland and Finland, the productive sectors have been growing faster then the supply of scientists and engineers. Austria, Luxembourg, Belgium, the Netherlands and Sweden also risk opening a gap between supply and demand unless they adjust current policies to ensure an increase in supply. Less advanced countries such as Cyprus and Malta have suffered structural inadequacies in the supply of science and engineers, and several new member states need to catch up to the more developed EU member states.

The policy responses vary from the creation of new universities to directly address the shortage (Cyprus and Luxembourg), to holistic approaches and specific measures. Ireland and Finland demonstrate the most systematic policy approaches. In the 2004 budget, Ireland funded institutional and specific measures to develop more world-class research centres, to produce more PhDs and post-graduates, and to assure new additional R&D credits. A new S&T promotional programme, 'Discover Science & Engineering', was launched in November 2003 to increase general public awareness of science and technology and to increase the number of students choosing science and technology degree programmes.

Several Dutch ministries have produced a joint action plan to address the shortage of scientists and engineers. An example is the Axis Foundation, set up in 1998 and replaced in 2004 by the Platform Science/Technology. The purpose of these programmes is to reduce the shortage of technically skilled personnel and the declining enrolment in technical education. The 'Jet-Net' action focused on integrating technology into primary schools by stimulating science in the classroom with the support of the five biggest multinational companies in the Netherlands. Belgium still lacks a concerted and sustained effort to promote scientific and technological careers, despite a large number of direct or indirect measures such as grants and taxation incentives for recruiting and employing scientific personnel.

With a low share of graduates in science and engineering, and with lifelong learning activity insufficient and barely improving, Estonia faces a key challenge to match the qualifications' profiles of the tertiary-educated working population with future needs for scientists and engineers. The latest Government strategy, *Estonia Success 2014* (4th September 2004) sets out a number of objectives and targets relating to this challenge including 1) increased focus on investment in higher education, 2) greater involvement of foreign teachers in higher education, 3) development of a national quality assurance system to guarantee the international competitiveness of higher education curricula and teachers; and 4) facilitation of employment of certain persons with a higher than average level of competence in Estonia. The strategy also aims to facilitating the return of 1,500 Estonian expatriate researchers, teachers, and skilled workers.

The Latvian government's 2004 Action plan of the National Programme on Innovation includes three actions for the promotion of human resource development: 1) development of scientific and academic staff; 2) increase in the number of engineering graduates; and 3) support to the improvement of employees' professional skills.

Immigration as a source of the highly skilled

Europe benefits from immigration flows, both economically and demographically. The population of nearly all European countries is expected to fall by about 10 percent in the first half of this century, and the dependency ratio (the population below age 15 and above age 65 divided by the population aged 15-64) is expected to nearly double. Immigration can provide some temporary relief for Europe's ticking demographic time bomb. In addition, employer surveys conducted in 2000 and 2002 confirm labour shortages for skilled and/or unskilled personnel, while estimations of the size of the "unused or latent labour supply" in Europe varies from 18 to 22 percent in Switzerland and Sweden to 40 percent in Italy.

Attracting skilled immigrants is one way of increasing the stock of knowledge in Europe and overcoming shortages in scientists and engineers. Many of the developed countries are competing for highly skilled immigrants by adopting specially targeted immigration programs that either uses point systems, as in Canada, Australia, and New Zeeland, or incentive policies such as tax relief programs.[29]

The 1999 Amsterdam Treaty committed the EU to develop a common immigration policy by 2004. Nevertheless, European leaders are still debating a common European immigration policy (see the forthcoming European Green paper on immigration) and there are several different approaches to immigration in Europe today. France, Germany, Italy, and the United Kingdom, who received about 88 percent of immigrants in 1995, have responded with different policies over the last decade. France and Italy have periodically legalized unauthorized foreigners, while Germany and the UK have tried to reduce the number of asylum seekers and are actively trying to attract high-skilled immigrants.

The French 1998 law on immigration was formulated in response to the perceived deterrence for foreign students and young professionals from settling in France by the 1993 Pasqua law. The 1998 law was inspired by the US visa provisions for highly skilled immigrants, and create a special status for scientists and for scholars. As an example of other measures from 1998 aimed at easing the conditions of entry for certain highly skilled professional categories, computer experts and highly qualified temporary workers earning more than a certain amount of income benefited from a

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[29] Annika Forsander at CEREN, Helsingfors universitet, 2003

simplified one-year-permit procedure and could request family reunification.[30] Despite this, France still appears to lag behind in the global competition for highly skilled mobile labour.

The German government issued the first "green card" in February 2000, as part of a programme that allows non-EU foreigners to enter Germany for up to five years, in response to requests from the private sector for computer programmers and other professionals.[31] Since 1997 the British government has relaxed the rules requiring proof that no British or European citizen can be found to perform a job, and is actively recruiting highly skilled workers. As a result, the number of work-permit holders and their dependants admitted to Britain each year between 1997 and 2003 rose from 63,000 to 119,000. Over two-fifths of the 54,000 British work permits granted in 1997 went either to Americans or to Japanese, mostly for highly skilled jobs.[32]

Today, Germany and Britain both aim to copy the Canadian system, whereas Americans think that the job market is the best judge of what is needed.[33] Canada's immigration admission system, copied by Australia, is based on a point system, with points awarded for characteristics such as skills, education, language and youth. According to Labour's proposal in connection with the 2005 British election, skilled employees might be attracted by a potential future point system, where highly skilled immigrants would be known as Tier 1 applicants, but will be assessed in much the same way as before; and skilled migrants would as a result be known as Tier 2 applicants and will be able to apply for settlement after five years.[34]

In Finland, the Finish Aliens law of 2004 grants the Ministry of Labour authority to make decisions on case-by-case evaluation of candidate credentials, depending on the labour market needs. Finland has no systematic policy or recruitment plan for future labour immigration but has in recent years admitted tens of thousands of immigrants who have first secured job contracts with Finnish employers. The Finish government has yet to decide if it will use an immigration system favouring skilled, educated labour immigrants, such as a point system.[35]

Support for post-docs
According to a survey by the European Commission, at least 10,700 post-doc positions (schemes or programmes resulting from an open call for proposals) were awarded across the EU in 2004, with the average post-doc candidate earning €22,700 per year. Of these, 2,100 were awarded by pan-European organisations such as the

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[30] Virginie Guiraudon; "Immigration Policy in France", U.S.-France Analysis, January 1, 2002, National Center for Scientific Research (CNRS)
[31] Philip Martin,"Europe: A New Immigration Area?", Population Reference Bureau, 2005
[32] The Economist, "A Continent on the move", May 4, 2000
[33] Highly skilled permanent employment-based immigration accounts for only a about 3% of the total number of US immigrants, with the bulk of immigration from family reunions.
[34] The Economist "A new improved races card", April 7, 2005
[35] Arno Tanner, "Finland's Prosperity Brings New Migrants", Finnish Directorate of Immigration, November 2004, mpi 2005

Commission's Marie Curie programme.[36] Despite the average duration of a post-doc of two years, Austria, Finland, Germany, Spain, Turkey and the UK offered contracts for five years or longer to allow post-docs to pursue longer-term research objectives. Most post-doc schemes in Europe were open to non-nationals of the country offering them, and several schemes targeted nationals working abroad. France, Germany, Norway, Spain, Switzerland, and the UK each award more than 200 post-doc positions a year.

There is no consistency across the EU in the size of post-doc schemes, their duration (mainly between 6-24 months but sometimes up to five years and extendable), and requirements. A few schemes are part of well-defined career paths (e.g. the five-year schemes), whereas other schemes serve as bridges to the private sector. Others still are elite schemes that prepare researchers for academic careers in research institutes or universities.

4.2.3 Knowledge production

All EU national governments support knowledge production through direct or indirect (tax instruments) policies to support R&D, both in the public and private sector. In addition, there are three other types of national policies of relevance to knowledge production: policies to improve the innovative capabilities of firms, usually SMEs that lack internal research capabilities; support for research collaboration between private firms, and programmes to encourage linkages between the public research sector and private firms.

Improving innovative capabilities

Many EU member states maintain a range of programmes to improve the 'absorptive capacity' of firms, or their ability to either (1) successfully adopt (adopting and modifying) technologies developed by other organizations, often seen as an issue of diffusion or technology transfer) or (2) implement new technology and develop innovations in-house. The capacity of a firm to use these discoveries depends on its ability to understand them and to assess their commercial applications. Any activity that a firm undertakes to deepen and widen its scientific and technological skills will also improve its capacity to absorb knowledge from external sources. Most programmes in this category are focused on improving absorptive capacity among SMEs.

The front-line programme in most EU member states is a system of regionally-based technology transfer or innovation offices to provide support and technical advice, such as the Manufacturing Advisory Service and the Innovative Manufacturing Research Centres (IMRCs) in the UK, ANVAR in France, and the TIC-net regional information and consulting centres in Denmark. Greece has established a network of 13 regional technology centres. These offices provide general educational

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[36] Inventory of Post-Doctoral schemes in Europe –draft version available on 2005-Nov-15 at

programmes, customized assistance and consulting services, and information on national assistance programmes. Another trend is towards 'one-stop' technology centres to assist firms. For example, the Netherlands has merged Senter and Novem to provide better support (and scientific links) to industry.

General education programmes include demonstration projects (usually located at research institutes), courses on innovation management and visits to successful innovative firms. The goal is to reduce the risk of their adoption by helping the firm make an informed decision. An example is the PEPER programme in Greece. The UK provides extensive educational programmes on how to manage innovation, using forums, seminars, conferences and workshops that focus specifically on this topic. Several countries run programmes where SME staff can visit successful innovative firms in order to learn about best practice in their industry. The leading example, which has been copied by several other EU countries, is the Teaching Company Scheme in the UK.

A programme common to many EU countries to improve the absorptive capacity of firms is a hiring subsidy for technical staff. Examples include the CORTECHS and CIFRE programmes in France and HERON in Greece. Several countries (among others Denmark and the UK) design the subsidy so that the new employee provides a direct link between their university or technical institute and the firm.

Most programmes to build absorptive capacity are not linked to specific technologies. However, a few countries offer programmes to encourage firms to adopt targeted technologies or even offer financial subsidies for this purpose. For example, France provides soft loans to SMEs for the adoption of computer integrated manufacturing equipment.

Research collaboration

Many national programmes subsidize technical collaboration and networking between firms or between firms and PRIs. To the best of our knowledge, all EU member states subsidize the creation of sectoral or regional networks of firms. Policies to promote networks and regional or sectoral clusters have been increasing in popularity in Europe over the last decade. The April 2002 German White Paper on innovation policy particularly stressed the value of networks, which are now explicitly recognized and constitute a 'significant change in innovation policy making in recent years'.[37] Relevant German programmes include InnoRegio, EXIST, and BioRegio. The Italian program PIA provides subsidies for the establishment of networks among firms in a similar sector. ANVAR in France promotes networks between SMEs and large firms. Another programme, RRIT, supports research and innovation networks in strategic technologies. The Dutch policy to support clusters was established in the early 1990s. Furthermore, the Dutch government's procurement programmes for

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http://europa.eu.int/eracareers/pdf/inventory_en.pdf
[37] TrendChart Country Report for Germany, October 2002.

innovative technology favour networks between contractors. The UK gives a high priority to encouraging clusters, primarily at the local level, with most support provided by the Regional Development Agencies. These provide forums and workshops where staff from different firms can meet.

Whether or not a member state provides a subsidy for inter-firm collaboration depends on its general approach to supporting private R&D. Countries that primarily subsidize R&D through tax credits, such as the UK, the Netherlands and Denmark, rarely provide direct grants to subsidize cooperative R&D among firms. Otherwise innovation policy stresses support for a favourable economic framework for business rather than direct financial subsidies for private R&D. Other EU countries provide direct grants for collaborative R&D between firms, though often with some limitations.

Commercializing publicly-funded research

European policy has gradually refocused the overall policy target from passive support for the creation of new ideas to a concerted effort to ensure that these ideas find their way to firms that can apply them to their new products, processes and services. As a consequence of the adoption of the NIS approach to innovation, all EU member states emphasize the need to promote knowledge flows between firms and between firms and PRIs in order to help turn public investment in research into successful innovations.[38] The goal is to overcome the 'European Paradox'. The two exceptions, Italy and Greece, recognize the importance of PRI-firm collaboration, but place greater emphasis on other areas due to the structure of their innovation system. For example, the focus of Greek innovation policy is on innovation finance and supporting start-ups in order to build up basic levels of innovative capabilities, while Italy's efforts are focused on major reforms to the public education and research system and developing a strategic vision for R&D that will meet Italy's future needs.

Two main types of policies are widely used. The first consists of incentives for PRIs to conduct research of value to the private sector. These incentives are often designed to influence the activities of universities or institutions where the research agenda has traditionally been determined by academic criteria rather than by the needs of government or industry. The second policy area, which has attracted an enormous amount of attention and funding over the last decade, consists of financial support for collaboration between firms and PRIs.

Many member states support institutions with a specific mandate to conduct research of value to industry. The classic example is the Fraunhofer Institutes in Germany. Nevertheless, many of these institutions are under pressure to further increase the commercial relevance of their work, the efficiency with which technology is

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[38] Such cooperation is a major emphasis of recent policy documents in Germany, France and the Netherlands.

transferred to firms, and the percentage of their operating costs that is funded by contract research.

Long-established public research institutes often specialize in innovation of relevance to low or medium technology sectors, such as agriculture or machinery, with many SMEs. These firms often lack the financial resources or expertise to solve technical problems in-house. The applied research institutes offer SMEs basic technical services for free or for a low fee.

Ongoing concerns in Europe about being left behind in strategic or enabling technologies have led to the establishment of new research institutes in advanced technologies such as ICT, nanotechnology and biotechnology, where commercial applications are fed by scientific advances. Many of them are virtual research institutes that link researchers from several universities, PRIs and firms. This results in considerable savings and is expected to increase the efficiency of existing expertise by improving knowledge flows and cooperation. Virtual research institutes can also encompass both basic and applied research, since there is no existing 'research culture' that must be overcome. Examples include Denmark's 'Large Cross-Disciplinary Research Groups' and the Thematic Research and Innovation Networks (RRIT) in France In addition, basic and pre-competitive research institutes are usually established in strategic technologies such as biotechnology or microelectronics.

Other programmes to encourage PRIs to conduct research of relevance to business include both programmes that actively direct research into business relevant research and passive programmes that establish the potential for contacts between academic researchers and firms. As an example of the latter programme, all EU countries now provide Technology Transfer Offices (TTO) that can assist academics with establishing a commercial spin-off, patenting an invention or arranging a licensing agreement with a firm (OECD, 2003). Both TTOs and science parks can also provide opportunities for contacts between industry researchers and academics.

A few EU member states have introduced one of two mechanisms to deliberately target academic research funds towards areas of value to industry. First, they include representatives from industry who take part in the funding decisions and second, they use the results of the Technology Foresight reports to identify promising technologies with potentially large markets. In some countries, such as Denmark, the Foresight exercises directly influence research priorities in PRIs, while in other countries the link is either not yet worked out or is indirect. Over time, PRIs are expected to fund a percentage of their research from 'third stream' or private sources in some countries. Both the Netherlands and Denmark have revised legislation covering the mission of universities to include the dissemination and application of knowledge.

Germany, Italy, the Netherlands, the UK and Denmark subsidize firms to either contract out research to PRIs or conduct collaborative research with PRIs. This type of subsidy is justified by the need to overcome some of the disadvantages of

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contracting out research or collaborating with universities and PRIs. These include concerns over confidentiality, higher risks for the basic and pre-competitive research, where the expertise of many PRIs lies, and a preference for firms to keep more applied and commercial research in-house. In addition to producing research output of value to industry, these programmes can assist in developing expertise within universities and PRIs on problems of importance to industry.

4.2.4 Entrepreneurship and creative destruction

Programmes to support entrepreneurship include subsidies for venture capital and educational programmes to support entrepreneurial and business training in engineering and science faculties as part of a wish to build a culture in favour of entrepreneurship.

Policy makers in Europe are aware of the need for entrepreneurship and increased efficiency in start up promotion and financing of new business ventures. Several policy initiatives are listed already in Green paper from 1995. Despite initiatives in several European countries of grants to start-ups (Sweden, The Netherlands among others), Europe is lagging behind in this aspect when compared to the United States.

On the assumption that private venture capital cannot meet demand due to information asymmetries, several countries subsidize venture capital. When the Swedish government released a national strategy for innovation in June 2004, it also released a plan to reform the early phases of the Swedish venture capital market. France's policies in this area are rather technical, such as prolongation and considerable extension of the coverage of the R&D tax credit (Crédit Impôt Recherche), as well as the definition of two new fiscal statuses directed at young innovative firms (the 'Young innovative enterprise - JEI' and the 'Uni-personal society of risk investment - SUIR'. Italy follows a similar route with measurements largely based on automatic mechanisms such as tax credit (for investment in new machinery and training of staff) and, in recent years simplifications of the application procedures in order to encourage the participation of SMEs. A new law 'Tecno-Tremonti' makes it possible for to reduce the taxable income by R&D costs including patenting, in addition to the normal deductions.

The 'Maisons de l'entrepreneuriat' is a recently implemented measure in France to foster an entrepreneurship culture within the academic world (TrendChart, 2004). Another new measure is tax relief for researchers taking up residence in Italy, aiming at encouraging foreign researchers to come to Italy and possibly establish a start-up.

The issue of creative destruction is a sensitive issue in a Europe marked by structural unemployment. The not yet mature ICT sector might prove a wise place to start, and the 'i2010 – Responding to the Challenge' report[39], claims that a process of creative

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[39] The i2010 Conference was held in London in September 2005, as the main ICT strategy event during the UK's Presidency of the EU. The conference brought together governments and business

destruction is required for the success of Europe's Information Society. According to the report, greater investment in ICT capital and skills alone would deliver low returns. For productive and profitable use of ICT, wide-ranging changes in the organisation, management and location of activities are needed. This would involve the entry and exit of firms as well as the hiring and firing of labour. A key recommendation is to implement e-government initiatives that focus on the *quality* of services to promote ICT use, rather than the *quantity* of services offered.

4.2.5 Structural and organizational change

Despite the importance of organizational innovation, there are few national policy initiatives in this area. It is recognized that in a competitive environment, organization responsiveness is a key component for business survival. The most widespread organizational innovation is the introduction of teamwork, as well as the ISO9000 organizational standard. Concepts such a Total Quality management, Just-In-Time, and Customer Service Management systems are all organizational innovations. However, there is a need for national policy support for the implementation of organizational solutions to the challenges of increasing globalisation. Again, the level of awareness varies among the different members states.

4.3 National Innovation Systems

The phrase "national innovation system" (NIS) refers to the interactions among participating institutions, organisations and firms within a country. A NIS encompasses both co-operative and competitive interactions. Within a NIS there is no single entity with the power to control the workings of the system, but there are many which exert significant influence. The direct function of government and policy makers to influence the system is through policy formulation and resource allocation, specialised advisory functions, and regulation.

With 25 member states, the European Union by definition has 25 unique national innovation systems. This would require a careful assessment of the relevance to a KBE of each of 25 different sets of policies, which would be very a complex task. Fortunately, although each NIS is unique, European member states share similar characteristics and innovative capabilities. For instance, Portugal and Greece share similar industrial structures with an above average share of GDP due to tourism and agriculture, while Finland and Sweden have advanced ICT manufacturing sectors. A high percentage of firms in Finland and Sweden perform R&D in-house, whereas a relatively high percentage of Portuguese and Greek firms innovate through purchasing new technology. Given these similarities, it should be possible to identify policy mixes that should function reasonably well among countries with similar NIS's.

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from across the EU to actively contribute to defining the i2010 ICT strategy to bring the EU forward until 2010. report written by Indepen for the DTI.

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Using national data on seven factors related to innovative capabilities, a recent Trend Chart report used cluster analysis to classify EU member states into four similar groups, shown in Table 6. The analysis is based on indicators that are relevant to all five of the main characteristics of a KBE[40]. The seven factors are innovation drivers (indicators for human resources), knowledge creation, entrepreneurship, innovation outputs, intellectual property outputs, domestic demand for innovative products, and innovation governance (Arundel and Holladers, 2005).

Peer countries can share many similar features that are of relevance to policy. For example, many of the new member states are in the same peer group and share low levels of patenting and R&D, 'Trailing'. In these countries, policy makers should focus on developing R&D capabilities rather than on increasing the number of patent applications. Similar features of peer countries are discussed below.

Table 6. Trend Chart cluster results for innovation	
Cluster description	**EU countries within cluster**
Leaders	Finland, Sweden, Denmark
Intermediate (followers)	Austria, Belgium, Netherlands, UK, Germany, France, Italy
Trailing	Spain, Lithuania, Slovenia, Czech Republic, Hungary, Slovakia
Laggards	Estonia, Greece, Latvia, Poland, Portugal

Source: Innovation Strengths and Weaknesses, European Trend Chart On Innovation, 2005

The four clusters for the EIS are approximately ranked in order of innovative performance, with the most innovative country cluster (Leaders) including Finland, Sweden and Denmark, and the least innovative cluster (Laggards) including Greece, Latvia, Slovakia, Portugal, Estonia, and Latvia.

The leading group of countries share many similar characteristics, such as highly educated populations, high levels of social cohesion, and above average levels of value-added from ICT manufacturing and other medium-high and high technology sectors. All three countries excel in creative, R&D based innovation. They also share similar approaches to policies of relevance to a KBE, such as an integrated approach to innovation and education policy and a stress on collaboration and life-long learning. There are also differences, with Sweden having less success than Finland in attracting students to follow S&E programmes and both Sweden and Finland have been less successful in encouraging start-ups than Denmark.

The intermediate or follower countries such as Germany, France and Italy are a much more diverse group than the leading countries. Manufacturing value-added, with a few exceptions, is dominated by medium technology sectors such as machinery, automobiles, and chemicals that depend more on engineering improvements and

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[40] Indicator coverage is best for three drivers: production and diffusion of ICT, skilled human resources, and knowledge production; and based on only one indicator each for entrepreneurship and creative destruction and for structural and organisational change.

product differentiation, which require less investment in R&D. Firms in several of these countries, such as Belgium and Austria, place greater emphasis on adopting innovations than on creating them in-house.

In respect to policy, the main differences between the intermediate and leading countries is greater difficulty in developing integrated policy approaches to the demands of a KBE, which could be why there is greater variation in performance on each of the seven factors in the cluster analysis. The lack of integrated policy approaches is partly due to the economic complexity of the larger EU member states (all of which are in this cluster).

The trailing countries, such as Spain and five of the new member states, have invested in public infrastructure, education and public-sector R&D, but are still lagging well behind on private sector activities of relevance to a KBE, such as business R&D, innovation and entrepreneurship. They consequently face a major policy challenge in getting private firms to invest in training, innovation, ICT adoption, and organisational changes.

The laggard countries, which include Portugal and Greece plus several of the new member states, differ from the trailing countries by a tendency to perform poorly on both public and private sector characteristics of importance to a KBE.

Many of the new member states are in the process of developing policies of relevance to a KBE. Consequently, it is too early to be able to assess the relevance of policies in many of these countries for a KBE. Several of the new member states are stressing policies to support clusters and collaboration (Czech Republic, Hungary, Slovakia, Slovenia), but so far the new member states have taken very diverse approaches to policy.

Policy relevance of the NIS-cluster approach
Given the different NIS's among the EU-25 member states, we would expect a range of policy approaches to encouraging a KBE. The use of cluster analysis to identify countries that share similar characteristics can help guide the development of suitable policies and targets over the short and medium term. The methodological approach follows a recent OECD study (2005) that notes that "the benefits of countries' science, technology and innovation policies, including specific policy instruments, cannot be adequately assessed outside the specific context of the national innovation system for which they are designed (page 7)". Sound indicators on national innovation characteristics are essential for assisting policymakers. As an example, policies to support the Barcelona 3% R&D intensity target must take differences in industrial structure into consideration, with the goal entirely unfeasible for economies that are currently dominated by tourism, agriculture, and low technology manufacturing sectors (Portugal and Greece, for example). Similarly, policies to encourage patenting are likely to be of little value in many of the new member states and Portugal and

Greece, where innovation in the private sector is focused on technology adoption, with very little R&D.

However, the long-term perspective is a different matter. Here, the goal of policy might be to encourage shifts in industrial structure, so that Portugal develops new economic sectors where firms compete on the basis of innovation in order to earn the extra rents and terms of trade advantages that these sectors can provide. The ability of Portugal or one of the new member states to move in this direction – and the speed of the move – will depend on many other structural factors. Examples of these factors are the educational level of the population, the level of interest in science and technology, the availability of capital, and the incentives to start small innovative businesses and the promotion of entrepreneurial activities through policies along the lines of financing abilities, the cutting of red tape, and imposition of business standards, that will encourage entrances into the formal sector of small (family) business. Consequently, the most appropriate policy mix will depend on the industrial structure as well as on other economic and political factors that influence innovation opportunities.

5. Policy Needs and Priorities — Current and Emerging

5.1. Introduction

Policy and decision makers are under increasing pressure to implement policies that provide a fertile environment for businesses competing in a KBE and the integration of the KBE into social and cultural activities. Policy and decision makers are on the 'front lines' and can provide valuable insights into policy priorities and needs in the current political and economic environments. They can also help us thing about the future short- and medium-long term by suggesting continuing and emerging policy and priority needs.

An important link from policy to indicators for the KEI project is their reaction and perception of current indicators for their policy needs as well as for the future. This is valuable information. It can be used to provide information on current indicators such as which ones are used, which ones are useful, which ones are weak, and which ones might be outdated and no longer appropriate or useful. At the same time, policy and decision makers can provide insights for future policy needs and priorities to help us identify and develop indicators as well as priority setting for the short- and medium term(s).

An integral part of the KEI project is the identification (and consideration of solutions) for indicators for the KBE. Reviews of programmes and policies and existing indicators have been carried out. To move beyond reliance upon literature and policy briefings, research was undertaken to obtain timely and critical information from policy and decision makers on their needs for indicators in the short and longer

terms, in light of current policy priorities and policy demands as seen developing in the short- and medium-term. It was important that new and improved indicators needs to be carried out in light of feedback and input from the user community and in particular in consideration of intelligence gathered from the policy and decision making community including policy analysts and officials. Towards this end, a questionnaire was developed and a series of interviews conducted across the EU and among selected countries outside of the EU. All told, a total of forty policy experts and decision makers were interviewed.

5.2 Overview of the methodology

5.2.1 Questionnaire development

A main goal of the interview process was to collect information on their (e.g. senior policy analysts and/or decision makers) opinions on two key themes:

1. What policies issues are likely to develop over the short- and medium- term (the next decade)? and,

2. What are the indicators that will be needed to support policy development and debate for the identified priorities?

A questionnaire[41] was developed that included questions on:

- The respondents background – e.g. policy area of responsibility

- Current indicators
    - o Key indicators used
    - o Reasons for using the indicators
    - o Problems and limitations of current indicators
    - o Indicator gaps – useful for current issues but not available

- Future indicators

    - o Identification of emerging policy issues
    - o Types of indicators that would be useful in light of anticipated policy developments.

The interviews asked about indicator needs and policy challenges because both are relevant to identifying improved or new indicators. Policy analysts are not always aware of the types of indicators that could be obtained. Information on policy challenges can be used to identify additional indicators. Likewise, information on policy needs can be used to prioritise indicator development.

5.2.2 Interviewee selection

The goal of the interview process was to interview seasoned and experienced policy analysts and decision makers. Interviewees were selected by:

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[41] The questionnaire is presented in Annex B.

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- contacting countries' respective TrendChart representatives for recommendations, and

- contacting persons acting as policy advisors, policy makers, or in policy implementation and coordination.

In order to solicit the full opinions of the respondents, the survey protocol offered full confidentiality. This means that no information is provided that can be used to identify the respondent or his country. The original proposal was to conduct 20 interviews with policy experts in a selection of EU member states and 10 interviews with policy representatives in competitor countries such as the United States, Japan, Canada and Australia. The actual number exceeded the targets: 28 interviews were conducted with European policy experts and 12 interviews with experts from outside the EU. Table 7 shows the share by region.

A main goal was to identify new and improved indicators for emerging policy challenges. Consequently, the interviewees selected represent a diversity of policy areas of relevance to a KBE. No attempt was made to obtain a representative sample of policy experts by region and so the findings of the interviews are combined.

Table 7. Interviews by region.

Region	Percent
EU – Big Four (Italy, France , Germany and the United Kingdom)	30
EU – Small developed economies (Austria, Belgium, Denmark, Finland, Ireland, Luxembourg, the Netherlands, Sweden)	20
EU – Less developed economies (Greece, Portugal, Spain, plus 10 new members states)	20
Non – EU competitor economies (Australia, Canada, Japan, Mexico, South Korea, New Zealand, United States)	30
Total	**100**

Interviewees came from different backgrounds, but with a common interest and involvement with policies and indicators. Table 8 summarizes the areas of policy and indicators represented among the interviewees.

Table 8. Background of interviewees.

	Percent
Policy maker	22
Policy advisor	25
Policy coordination / implementation	20
Policy evaluation	20
Statistical agencies	7
Academia	5
Total	**100**

5.3 The Findings

5.3.1 Drivers of current policies

The main drivers that conditioned the development of current policies come from government initiatives at the national (country) and EU level (European Commission). Typically, EU policy sets the direction for short- and medium term goals and national governments develop strategies to meet the goals. An obvious example is the Barcelona target.

For some, the need to compete and/or the need to respond to growing competition is driving growth of government spending on R&D. Apart from making available more resources, this increased government spending on R&D is driving a need for more accountability of the resources and the outcomes of the increased funding.   Table 9 gives a summary of the main drivers of current policies.

Table 9. Main drivers of present policies.

	Total citations	Percent
Government initiative (national or EU level)	13	24.1
Collaborations, networks, clustering in applied research	10	18.5
Human resources (education and mobility)	6	11.1
Information Society (use of internet)	5	9.3
Globalization	5	9.3
Infrastructure / ICT	4	7.4
Venture Capital / entrepreneurship	4	7.4
New Technologies / convergent technologies	4	7.4
Process Innovation	3	5.5
Total	**54**	**100.0**

Note to number of citations: respondents could identify more than one main driver.

Moving away from government driven initiatives, the key driver was the changing environment of R&D and innovation. The increase in the associations between the private sector (businesses) and universities in the form of collaboration as well as business partnerships has been driving policy change in recent years. One reason for this is the growing emphasis on goal-oriented (applied) research that can lead to commercialization. Businesses and universities are working together given the high costs of R&D and the need for returns for continuing development of new products and services. Consequently it comes as no surprise that the need for cooperation among the R&D and innovation actors has driven the demand for policies to support and/or facilitate the new relationships among the various actors. These two drivers, **government initiative** and **need for collaboration** were identified as the most important.

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Other drivers that were identified include the concerns surrounding human resources and the need for highly skilled workers (e.g. education and mobility). The "Information Society" and the use of internet in terms of "e-business", "e-commerce" and "e-government" were also identified as drivers of policy change. Globalization and the need to compete with emerging economies, such as China and to a lesser extend India were also mentioned as important drivers for policies now in place. Globalization has brought about profound changes in the way countries relate to each other. New players, such as low cost eastern European countries, and Asian countries, most specifically China, have captured a great proportion of manufacturing, causing countries with significant portion of their economies in the secondary sector (manufacturing) to re-adjust their economies, either abandoning the market or moving to more added value manufacturing.

The development of an infrastructure that facilitates R&D was also identified. More specifically, ICT and its continuous development are seen as facilitators for continuous research. The importance of an appropriate infrastructure for further development was particular relevant for developed economies. Venture capital and entrepreneurship were considered important drivers for both advanced economies, as well as for economies that are still highly dependent on the secondary sector. Taking risks and initializing new ventures are important factors for both types of economies. Policies in this area focus in creating the proper environments for individuals to either start new companies or to develop spin offs from other business and / or universities' labs. Finally, the emergence of new technologies, such as nanotechnology, biotechnology and technology convergence have been important drivers in the creation of policies that facilitate further development of these important sectors as well as that guarantee a country' participation in those technologies.

When asked if government policies to promote the KBE, globalization or new technological development have been the main drivers behind present policies, most respondents ranked globalization and new technologies as most important.

5.3.2 The use of targeting policies
All of the countries covered in the interviews reported targeting policies, albeit to lesser or greater extents. Some make extensive use of targeting polices while others are more generalist. During the probing of targeting policies, problems associated with targeting policies were identified as an important issue. Table 10 summarises the areas with targeting policies.

Table 10. Areas targeted by policy.

Targeting Area	Total	Percent
SMEs	10	11.8
Education / training	10	11.8
Collaborations / networks / clusters /spin-offs	10	11.8
Women	8	9.4
Energy / environment	7	8.2
Entrepreneurship / VC	7	8.2
ICT	6	7.1
Nanotechnology	4	4.7
Elderly	3	3.5
Social	3	3.5
E (government, commerce, business)	3	3.5
Rural areas / regions	3	3.5
Fashion / textiles	3	3.5
Agriculture / food / flowers	3	3.5
Aerospace / defense	2	2.4
Exports sectors	2	2.4
Biotechnology	1	1.2
Total	**85**	**100.0**

The top areas of concern (SMEs, education and networks, cluster formation and support for spin-offs) as well as education (and training) collaborate the ranking of policy drivers identified in Table 10. The issue of women, in terms of participation in the work force and as researchers, is another area targeted by many of the countries interviewed, especially in the highly developed economies. Many of the surveyed countries emphasized entrepreneurship and venture capital, energy (and alternative types of energies) and environment.

5.3.3 The use of current indicators
 The use of indicators identified by the interviewees can be grouped into six broad categories:

1. Knowledge creation — e.g. BERD, GERD, other R&D related indicators (e.g. patents).

2. Innovation drivers — human resources, broadband.

3. Knowledge building and networking — transmission, application, and output covering clustering, networking, knowledge building and knowledge sharing,

collaborative R&D, connectedness, transfer of knowledge, linkages between science and innovation, linkages between universities and businesses, spin offs, as well as new to market (products and services) , new to firm (products and services) and non-technological innovation.

4. Finances — venture capital and entrepreneurship, ICT expenditure and innovation expenditures.

5. Macro-economic performance — GDP, employment.

6. E- government, e-commerce and e-health.

Table 11 summarizes the main types of indicators in use.

Table 11. Indicators by broad category of use.

Type of Indicator	Total	Percent
Knowledge Creation	14	28
Innovation Drivers	12	24
Innovation Finance	9	18
Transmission, Application and Output	8	16
Macro-economic Performance	5	10
E-Government, e-business, e-health	2	4
Total	**50**	**100**

Reliance upon the 'traditional' indicators continues. For example, under 'knowledge creation' we have R&D expenditure indicators, patents, citations etc. Indicators of innovation drivers in the KBE prioritise knowledge creation from another dimension — human resources (supply and mobility) and ICT in terms of broadband. Although less frequently cited but still important are indicators for finance (e.g. venture capital, SMEs, ICT) and transmission and diffusion including commercialization, new markets and non-technology innovation). Macro-economic indicators (e.g. employment/unemployment, GDP) remain core and key indicators for policy and decision makers. Other indicators, such as e-indicators that measure sectors such as e-government, e-business and e-health were also identified. The results suggest that policy still relies upon core indicators developed for different economies, indicators that have a long history in S&E and innovation and related policy. Although new indicators are available, this does not mean traditional long standing indicators are being discarded. In fact, the interview results suggest that the traditional set of indicators is still the most popular.

5.3.4 Quality of current indicators
Interviewees were asked for feedback on the quality of the indicator(s) they rely upon. Quality is judged according to scope (variables), timeliness and comparability. Apart from being asked what the current indicators in use are, this survey was also interested on the quality of the indicators in use.

Overall, there is dissatisfaction with the scope and detail of current indicators as well as concern about their timeliness. Timeliness of current indicators is clearly a concern, identified again and again as a failing or weakness of existing indicators. Except for two developed countries that did not mention either problem, all other countries fell in line identifying the weaknesses of current indicators.

5.3.5 Adequacy of current indicators

People were asked to identify current indicators that are inadequate, outdated or even obsolete for their respective policy areas. All countries but one pointed to the inadequacy of current indicators. The main remarks related to problems of definition, classification, measurements, differences in approach, lack of precision, need for standardization, comparability, need for consistency, coherence, reliability and finally interpretation.

A key criticism of current indicator inadequacies focused on definition and concepts. There is a lack of understanding of definitions and concepts that can turn into misinterpretations of economic and social activity. Interviewees voiced an urgent need for standardization of definitions and measurements in order to enhance the adequacy of existing indicators. There is a feeling that a lack of a common definition and well-defined measurements has led to a lack of reliability of current indicators, indicators especially prone to misinterpretation.

Lack of consistency of current indicators is problematic and makes it difficult if not impossible to compare trends over time. Trend indicators are important for policy and decision makers and planners.

Indicators are perceived as limited in their ability to explain behaviour in the KBE (e.g. firms, individuals). For example, there are indicators on flows of knowledge workers but little is known on factors. There are indicators on innovation at the firm level but few indicators that reveal non-technological innovation and its contribution to firm growth. Other negative aspects that were identified include timeliness, lack of details (or excessive details), sample definition, sample representativeness, and cultural differences.

Persons were asked to identify indicators that they considered obsolete or wholly inadequate. In this instance, it was indicators for telecom/related and patent/related were identified as the most inadequate. Indicators for R&D, number of researchers, papers and citations were also criticized. Table 12 presents a summary of indicators identified as inadequate or obsolete.

Table 12. Indicators considered inadequate or obsolete.

Indicator	Details
Telecom Indicators	Penetration, tariffs, % of telephone use
Patent Indicators	Number of patents per inhabitant
R&D Indicators	Too many details, R&D expenditure as a number, R&D intensity Need for breakdown into basic, applied and development
Graduates / Researchers	Researches per 1,000 of population, Graduate students outcomes, Number of PhDs students
Papers and Citations	Lack of purpose

Telecom indicators are among those considered obsolete but patent indicators are seen as controversial. Patents are considered inadequate as they are not representative of scientists/researchers and there are no measures of outcomes or impacts of the patents.

5.3.6 Availability of indicators

Beyond observations on adequacy of current indicators, respondents also raised concerns on the lack of available information for KBE policy needs. Examples of areas lacking information at the moment relate to "soft indicators", measurements of impact, need for new measurements as a consequence of new technologies that did not exist in the past, need to follow technological changes and update the spectrum of available indicators, need to develop further composite indicators, more information on non-technological innovation as well on services indicators. Collaboration is also an area that needs to have better indicators and improved measures.

5.3.7 Indicators and future policy needs

When asked about availability of indicators for current and future policy development, respondents basically gave the same answers: indicators that are considered important and missing (or weak) in current set of indicators and measures are basically the same as the indicators that interviewees identified as important for the future.

A key area for indicator development (and current inadequacy) is related to innovation flow, from creation to commercialization. The need for more detailed information in terms of fields of research, type of innovation, innovation capabilities, new products, number of firms doing research in a certain country, adoption and diffusion of innovation, and innovation's value added were all identified. Ten of the sixteen countries highlighted the importance of having more **indicators and information on innovation flows**.

Another area of concern identified for future (and current) policy needs is the need for **indicators on the economic impact of innovation** in quantitative terms. It is important to have quantitative results grants, subsidies and tax exemptions in order to evaluate innovations results.

Apart from these two main areas, several others had substantive support. There is a need for indicators on **collaborations**, indicators for linkages, clustering and networks. There is a need for indicators on researchers, in particular indicators are needed on researchers such as researchers per institute, category of research, gender, term of contracts, type of financing and mobility. There are perceived needs for continuing needs for indicators on type of education, number of students, mobility and job market. **ICT** was also mentioned as lacking relevant information. Respondents would like to measure usage and impact of ICT both at enterprises and households.

Apart from economic impact of innovation, **social impact** also needs to be measured. Respondents cited externalities as consequences of innovation, an area that needs to be explored. More specifically, **security** issues and its impact on immigration, research and foreign scientists were stressed in particular. Moreover, there was concern with the **involvement of consumers** in the innovation process.

Service innovation and its related areas, such as e-government, e-health and e-commerce were also mentioned in the list of priorities for indicator development for future policy needs. Table 13 identifies the indicators identified for future (and current) needs.

Table 13. Need for new indicators (future and current policy needs).

Types of Indicators	Total	%
Innovation Flow	10	15.4%
Economic Impact	10	15.4%
Collaboration	9	13.8%
Human resources – researchers	7	10.8%
Human resources – role of youth	5	7.7%
ICT	5	7.7%
Social Impact	5	7.7%
Innovation Services	4	6.1%
Entrepreneurship /venture capital	3	4.6%
Human resources: employment/migration	3	4.6%
Broadband	2	3.1%
Organizational aspects	2	3.1%
Total	**65**	**100%**

5.3.8 Future policies and priorities

The questionnaire included a question that asked about policy areas and types of policy that would be important over the short- and medium- terms, over the next five to ten years. Perhaps not surprisingly for a KBE, it was **human resources and education** that was identified as a top policy issue by fifteen of the countries

interviewed. Policies on **collaborations, technology centres and technology parks** followed closely behind in terms of identifying future policy developments for indicator need identification. Based on the interviews, the policy priorities emerging in the KBE today are going to be with us in the short- and medium- term (refer also to Table 2).

A third policy priority for the near future is **ICT** related. ICT is seen as the base on which technology development and transmission take place. It is a support to allow for further development. ICT was mentioned in terms of present policy thrusts, targeted policy and ongoing policy (future).

New technologies will drive future policy. For example, nanotechnology was identified as the fourth ranked policy priority for the future. Some twelve countries focused on nanotechnology and nine focused on biotechnology priorities. According to the interview results, biotechnology is considered a sector that is best developed by countries already engaged in this field whereas nanotechnology is a sector that is more accessible for new players (e.g. countries). New technologies are going to influence future policies.

Energy and environment policy, including pollution and climate change was identified as a priority policy area for the short- and medium-term. Although it was little mentioned as part of current policy focus, it is considered important in the future policy portfolio.

Areas related to **society**, such as welfare, health and aging of the population are to be included in the top policy priorities group according to the countries surveyed. Nine countries included them in their list of future priorities. Related to these areas of policy, labour, migration and mobility were also identified as policies priorities for the future.

Another important area that policy planners and decision makers have started to look upon and that will become even more important in the future relates to **venture capital and entrepreneurship**. The increased focus on this in the future means there will be demand for new indicators in these areas.

Globalization was mentioned, both in terms of European enlargement with the Eastern European countries and in terms of competition of newcomers like China and India. Policies priorities will need new and improved indicators for these regions.

Table 14 summarizes policy concerns for the short- and medium term.

Table 14. Policy concerns – Future.

Main Policies Concerns	Citations	Percent
Human resources - education	15	9
New technologies – nanotechnology, biotechnology	21	12
Clustering/collaboration//technology centers/parks	14	8
ICT related; communications technology; broadband	17	10
Energy/ Environment – pollution ; climate change	11	6
Society – welfare; healthcare; aging; labour/ migration/ mobility	17	10
Entrepreneurship / venture capital	8	5
Globalization	8	5
Information Society/ KBE	8	5
Security/privacy and terrorism	8	5
University research/spin offs	7	4
Business Climate	5	3
Convergence / Standardization	4	2
E-business /e-commerce /e-government	4	2
Infrastructure	4	2
Service Innovation	4	2
Taxation	3	2
Sustainable Development	3	2
Sector policies – e.g. aerospace and defense; agriculture; automotive; chemicals; engineering and machinery; fashion	13	6
Total	174	100

Summary of findings

A number of messages emerged including:

- Timeliness is important but international comparability is critical.

- There is a need for standardization of indicators among countries to facilitate comparison. Although indicators are presently used for basically benchmarking, there is a growing interest for public accountability of public spending programme and public institutions (return on investments), demanding for indicators that can support such evaluations.

- Globalization has brought about changes in the economic and social environments. Service industries continue to grow in importance. New products and new types of jobs have been developed while old ones have disappeared. New technologies have gained importance (e.g. biotechnology, nanotechnology). Indicators still, for the most part, measure traditional concepts of R&D and innovation. New indicators and classification systems need to be developed to reflect economic and societal shifts.

- There is a need to have a better understanding of innovation actors and linkages. Although there are indicators on activities (R&D, invention, innovation, diffusion of knowledge, technologies and so on), there is a lack

indicators of linkages among the actors, as well as indicators of **outcomes, impact** indicators and **human resources.**

There is a general malaise with indicators in that despite timeliness and quality being at its best, there is a lack of indicators and activities that can be used to produce the bigger picture. Indicators remain as a bunch of dots on the drawing board. Regardless of their timeliness and quality, the dots remain unconnected. There is a lack of indicators, measures that can be used to connect the dots to show the bigger picture of science and innovation in the KBE. For example, indicators and analyses are lacking to understand the dynamics among the actors in the innovation system. What do we know about the dynamics of knowledge flows? What indicators can we use to explain cluster relationships and the impact of these relationships? What about more indicators to measure the policy programme outcomes themselves?

The challenge is to understand the process and interactions of the system of innovation. How are structures (firm level, government policy, education) being reorganised and what does this mean for the component parts of the structures? Convergence of science and the multidisciplinary nature of research and innovation mean we need to have indicators of the outcomes for university teaching where the blurring of fields will bring about organisational change to university teaching departments. Clustering of innovation brings about the need to change policy behaviour and how will this affect mandates within the policy world and department responsibilities? Indicators of organisation innovation will be needed to understand the changing structure(s), management and leadership strategies needed to bring about positive outcomes of innovation. Indicators are still based on data on training in the workplace, an approach that has changed little over the last decades. How can indicators be developed to gather information on the impact of training and life long learning for innovation at the firm level instead of a limited focus on number of hours of training offered? Links between the development of practices and the impact of the practices are needed. Another example is the development and evolution of policies in light of economic, social and cultural change in the KBE. Indicators are needed for impact and policy effectiveness measures.

The interviews bring us to the observation that as efforts are underway to collect and develop indicators, it is important to measure and understand the behavioural aspects of the KBE. An area that was brought up again and again as an 'achilles' heel of indicators for the KBE is to do with the human actors in the science system. How is knowledge developed? How do networks and relationships develop and how does knowledge flow? What is the link to innovation and how can we measure the impact of knowledge workers and their relationships in the innovation system? How are university and industry relations changing and how does this impact on innovation? What measures to we have available to understand the competitiveness of the KBE with regards to openness, transparency and infrastructure, and how does this compare internationally? We have measures to show that collaboration among firms and

between universities and private industry may be taking place but we lack measures and indicators of why it is taking place — what is driving the behaviour behind the relationship? There is a lack of measures on collaboration and the impact of collaboration. Economic analysis of the disparate indicators we use and update is very limited in its use to explain what makes an innovation system stronger or weaker. Indicators are needed to quantity the various stages of the innovation system and to explain the relationships within the innovation system. Without these, policy will not be able to manage its responsibilities or provide support and catalytic solutions in a KBE.

6. Conclusions

With significant variations across Europe, catch–up policies and reforms have to take into account national conditions in order to implement effective pro KBE policies. KBE policy making requires an integrated or holistic approach to policy that can support each of the five main drivers of a KBE (see KEI deliverable 1.1).

Successful policy-making will require more information on new challenges, such as the impact of an ageing workforce, globalisation, rising imports and rising job insecurity. The rapid integration into the world trading system of China and India, with their huge pools of low-wage labour, and the recent enlargement of the European Union have fuelled fears of further job losses, as global competitive pressures increase. Today, on a micro level, only companies that innovate more quickly than the market changes will reap the benefits — and avoid the risks — created by rapidly shifting global trends. This is true also for national economies striving to stay competitive.

The ability to innovate quickly relies upon, to a certain extent, the health of the economic environment (availability of skilled labour, R&D funding, tools for commercialisation) that is nurtured and facilitated by the policy environment that is in turn informed and guided by indicators. Careful thought and planning are needed to identify and prioritize priorities and resources for appropriate and key indicators and indicator development for the short- and medium term policy needs.

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Annex A: Details of the Draft Action Plan

The Draft Action Plan proposes the following actions:

    Envisaged Action 1: Innovation benchmarking and promoting excellence at European level. The Commission will expand the collection of data on business innovation and analyze its forms and the way business interact. It will develop sectoral innovation models (taking into consideration existing initiatives such as e-Business W@tch1) including service sector innovation models, establish sectoral benchmarks and promote economic intelligence and methods of innovation management. In addition, networks will be set up, and best practices will be exchanged at European level.

    The Commission has invited the Member States to support it in this endeavour and to join a network bringing together the national initiatives in this field. In order for The Commission and the Member States to promote excellence, information on innovation leaders and on the winners of competitions for young innovative businesses should be collected in a Scoreboard of Innovative Enterprises. The Commission will provide opportunities for those who award the prizes and honors nationally and regionally to share their experiences. As a way of commending non-technical innovation, it will encourage and organize events such as a European award for design and a European entrepreneurs' day in a different European city each year.

    Envisaged Action 2: Promoting technical regulations and standards that foster innovation. In the context of 'Better Regulation', the Commission will develop ex-ante assessment of the impact of regulations and standards on innovation. It will develop analytical instruments for identifying and evaluating the size of potential lead markets. Moreover, the Commission and the Member States shall promote dialogue among stakeholders and the involvement of consumers, civil society and SMEs in impact assessment as well as in the regulatory and standardization processes. This will improve consumer confidence among other factors. Finally, the Commission will survey global regulatory trends and establish a standards watch in areas such as environmental legislation, ICT, and food safety. It will also identify and disseminate examples of best practice.

    Envisaged Action 3.1: Make the most of intellectual property opportunities. The Commission and the Member States could:
- Encourage diffusion and dissemination activities, raising awareness of knowledge contained in existing IP and IPR resources: real and potential value of an IPR; patent information as a business tool and protection and enforcement alternatives. The main tools for this are information campaigns, seminars, brochures and websites.
- Create, promote and support "first-line assistance services": training, advice on representation before the EPO and on professional IP management services, valuation and defence related to IP management (mainly for SMEs, in connection with action on non-technological innovation), identify and promote awareness of enterprises' concerns with regard to the use of IP protection rights and remove obstacles to new EU action or regulatory developments, at a global level if need be.
- Reinforce activity in different forums, whether internal or external (Member States, OECD, EPO, OHIM, WIPO and national patent offices); review, complement, support and improve the existing initiatives and structures.
- The Commission will benchmark the cost of patents in various regions of the world.

    Envisaged Action 3.2: Enhance knowledge transfer and absorption. The Member States and the regions are invited to stimulate the transfer and absorption of technologies to and between businesses, taking advantage of linking structures. The Commission will consolidate European platforms, networks and services for disseminating technology (IRCs1, Gate2Growth1, CORDIS1) and test new methods of transferring information between research and industry (methodologies for assessing and transferring to industry the results of publicly-funded research) and for the transfer or absorption of information between enterprises.

Envisaged Action 3.2.b: Foster cross-border exchanges between clusters. The Commission and the Member States will work to unlock clusters, through internationalisation, inter-regional cooperation and cross-sector fertilisation. Sector-specific benchmarking and dissemination of best practices will be encouraged by extending the current PAXIS initiative1 to local systems of innovation and clusters.

Envisaged Action 3.3: An R&D Framework Programme active for innovation. The Commission will pay special attention to innovation in preparing the future actions of the European Union in the area of research, in particular:
* The "innovation and SMEs" aspect in the strategic projects and a stronger taking into account of the needs of applied research (in particular within technology platforms), with the goal of helping improve industrial competitiveness,
* Action in favour of SMEs including actions aiding in the transfer and absorption of new or existing technology;
* Specific activities to foster innovation, namely regional actions to support innovation in an enlarged Europe, actions in favour of young innovative businesses, technology transfer and the management of IPR portfolios, as well as actions for technology mediation (networks, brokerage, licensing), a central Innovation Help-desk and strengthening of IPR assistance, experimenting with new types of action.

Envisaged Action 4.1.a: Reinforce the multi-annual programme's financial instruments. The Commission will strengthen the financial instruments in the support programme for enterprise, competitiveness and entrepreneurship. Their scope should be extended to innovative enterprises, both young high-tech high growth start-ups as well as existing SMEs in traditional sectors. Flexibility should be maintained to accommodate new financing needs that might emerge over the life of the programme.

Envisaged Action 4.1.b: Reinforce cooperation with the European Investment Bank (EIB). Cooperation between the EIB, the Commission and the Member States must be increased to take account of the action plan. The EIB's "Innovation 2010" initiative is a powerful instrument for supporting innovation, as this initiative will help develop regional innovation systems. It should focus on loans and global loans for innovative activities (in particular those of SMEs), for measures in favour of innovative mid-caps and for support infrastructure for young innovative businesses, such as science parks, business incubators and new facilities. Synergies between these actions and the risk capital activities managed by the EIF should be explored.

Envisaged Action 4.2: Increasing the impact on innovation of the Structural Funds. The Commission will dedicate an increasing share of the Structural Funds to innovation. To achieve this, it will develop guidelines that reflect the principles of this action plan, and focus on helping regions to implement ambitious innovation strategies. Among other things, the Structural Funds will help internationalise regional clusters, and will support projects fostering the absorption of knowledge and technology by SMEs in all sectors.

Envisaged Action 4.3: Increase synergies between innovation and State aid policies. The Commission will introduce aid to innovation in the future "LASA" (aid without a significant impact on competition) instrument[1]. By the end of 2004 it was foreseen to have elaborated a Vade-mecum on State aid and fiscal measures that favour innovation. By 2005, the Commission will be drawing up a Communication on State aid for innovation.

Envisaged Action 5: Identifying, promoting and simplifying access to innovation professions and skills. The Commission will study the skills needed for innovation in businesses. On the basis of the results, it could promote initial and ongoing training at EU level to match the identified needs for innovation skills, in particular e-skills and innovation management techniques. The Commission, the Member States and other stakeholders should promote the recognition of professions dedicated to innovation and encourage life long learning, mobility, particularly between sectors and towards SMEs. They should also mobilise women for innovation, by means of for example the "Women in industrial research" (WIR) initiative, and encourage ways to attract engineers and high-skilled employees towards SMEs.

Envisaged Action 6: Rallying Member States around the European model of innovation governance. The Commission, the Member States and other stakeholders will try to build consensus around common objectives that could be included as an annex to a European declaration on innovation. They could promote a society-wide debate on innovation policy and ensure follow-up, taking into account indicators and opinion polls.

Annex B: Survey Questionnaire

QUESTIONNAIRE ON KBE POLICIES AND INDICATOR NEEDS

Background: What policy area(s) are you responsible for?

A1.1 CURRENT POLICY. What significant changes, if any, have occurred in the past five years or so in your area of policy. What drove the change(s)?

a. **PROMPT** for any changes in policy in the last 5 years due to:

i. Government policy to promote a knowledge-based economy?

The general idea behind a knowledge-based economy is that economic competition increasingly depends on the use of knowledge and innovation. This includes not only high tech sectors, but also the application of new technology and organizational methods across the economy – services, 'low tech' manufacturing, and the public sector.

If YES – what has changed to reflect this?

ii. Change due to increasing concern over globalisation issues?
If YES – what has changed to reflect this?

Includes increasing off-shoring of production or R&D, mobility of skilled workers (including international migration of highly skilled workers), increasing global competition, increasing economic power of China and India, which increases both competition and potential markets for European goods and services, etc.

iii. Change due to new technological developments?
If YES – what?

Could include biotechnology, nanotechnology, ICT applications, new organizational methods, global supply chains, etc.

A1.2 CURRENT POLICY. Policies to promote a knowledge-based economy are often **targeted** - designed for specific sections of a population or economy. For example, some educational programmes are targeted to women, while many countries target innovation programmes to small firms or to specific sectors or technology fields. Are your national policies using any form of targeting?

A2.1 CURRENT INDICATORS. Which statistics or indicators do you currently find the most important for policy development in your area of interest, and what do they use them for?

a. **PROBE** for: are these indicators adequate for your needs in terms of:

i. *Scope* (cover all aspects of what they would like, for instance gender for education/skills, or sector for R&D)?

ii. *Detail* (for instance, available at the regional level, or for different firm sizes, etc)?
iii. *Timeliness*: not too long a gap between current year and data availability?

A2.2 CURRENT INDICATORS. Do you find any of the indicators that you currently rely upon to be inadequate, outdated, or even obsolete for your policy area needs?

       If YES, can you summarize the main problems?

A2.3 CURRENT INDICATORS. Can you think of data or indicators that are crucially important for **current** policy development in your area and which are simply not available today?

A2.4 CURRENT INDICATORS. Do you use any of the results of the Innovation Survey in your policy work? (CIS in Europe, other similar surveys for Japan, Canada, Australia, New Zealand etc)?

      iv. If YES: what results do you use and for what purpose?

        PROMPTS
        1. Evaluate policy performance?
        2. Assess national capabilities, weaknesses, strengths etc.
        3. Compare performance in [YOUR COUNTRY] on specific indicators against performance in other countries (benchmarking)?

      v. If NO or minimal use of innovation survey results: why not?

I would now like to ask you a few questions about policy concerns and indicator needs for the future, and if you see any necessary changes coming up. By future, we mean in the medium to long term, such as over five years from now.

B1.1 FUTURE POLICY: Do you see any major new developments or challenges in the future that would require a change to your current policies?

    If YES: what will be causing the need for these changes, and what types of policies will be needed to meet them?

B2. FUTURE INDICATORS: Are there **new** types of data or indicators that will be needed to help policy meet these future challenges?

B3. More broadly speaking, do you see other challenges on the horizon for policy development outside your policy area?

We will be producing a short summary of the results of this survey. Would you be interested in a copy?