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Investing in research: an action plan for Europe

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Foreword

An action plan to boost research efforts in Europe

At the March 2000 European Council in Lisbon, Europe set itself the ambitious goal to become the most competitive and dynamic knowledge-based economy in the world. To this end, Europe requires a new impetus, to which R&D contributes in an essential way. Without public and private investment in research, the leading source of creation of new knowledge, the EU economy would stagnate, deprived of its driving force, knowledge. Boosting investment in research is pivotal to the Lisbon strategy.

Following a wide consultation of European institutions, Member States, Acceding and Candidate Countries, as well as stakeholders such as European industry and the financial sector, the Communication "Investing in research: an action plan for Europe" sets out actions required to increase the level of investment in research in the European Union. As called for by the March 2002 European Council in Barcelona, this level should rise from 1.9% to 3% of GDP, with two-third financed by the private sector, by 2010 in order to close the gap with the current levels of research investment by our major competitors, such as the United States and Japan. Meeting the 3% objective is expected to create 0.5% additional GDP growth and 400,000 additional jobs in Europe annually after 2010.

This action plan is Europe's chance to boost its competitive potential and to ensure sustained improvements in the quality of life of its citizens. However, this requires the determined and co-ordinated efforts of all interested parties—Member States and Acceding Countries as well as public and private sector stakeholders. Everyone can and should contribute to making this action plan a success.

Philippe Busquin

1. Executive summary

The present action plan sets out initiatives required to give Europe a stronger public research base and to make it much more attractive to private investment in research and innovation. Carrrying out these actions will allow the European Union to bridge the growing gap in the levels of research investment between Europe and its main trading partners, which is putting at risk our long term innovation, growth and employment potential. The objective is to reach the objective set by the March 2002 Barcelona European Council, to increase the average research investment level from 1.9% of GDP today to 3% of GDP by 2010, of which 2/3 should be funded by the private sector.

To reach the Barcelona objective, research investment in Europe should grow at an average rate of 8% every year, shared between a 6% growth rate for public expenditure and a 9% yearly growth rate for private investment. This is ambitious yet realistic given the strong support given to the objective.

The March 2003 European Council called for the Commission to present this action plan, which has been prepared on the basis of a wide consultation of European institutions, Member States, acceding and candidate countries, as well as stakeholders from industry; public research and finance. The consultation showed a very broad support for the 3% objective. It revealed that most countries are already taking measures to boost investment in research, and that many have set national targets in line with the European 3% objective.

The action plan aims at building on this momentum, ensuring that the necessary initiatives at European and national levels are sustained, mutually consistent and commensurate with the challenge of bringing radical improvements to the European system of research and technological innovation. Europe is facing a situation where the weakest link in the system risks discouraging investment – to give but a few examples: the shortcomings and rigidities of research careers, leading excellent human resources to move out of research or out of Europe; the dispersion and lack of visibility of Europe's often excellent research; the difficulties encountered by technology-intensive SMEs to find financing for their research and innovation projects; or the lack of awareness of researchers and research managers regarding the protection and management of intellectual property.

The action plan complements a series of mutually reinforcing European initiatives aimed at boosting the Union's competitiveness, notably in the fields of enterprise and innovation policy, and of structural reforms in the product, services, capital and labour markets. Together they form the Commission's policy response to the March 2000 Lisbon European Council objective to "make Europe the most competitive and dynamic knowledge-base economy by 2010".

The action plan comprises four main sets of actions.

A first set of actions aims at supporting the steps taken by European countries and stakeholders, ensuring that they are mutually consistent and that they form an effective mix of policy measures. This includes a process of co-ordination with and between Member States and acceding countries. It also entails creating a number of "European technology platforms", which will bring together the main stakeholders – research organisations, industry, regulators, user groups, etc. – around key

summary

technologies, in order to devise and implement a common strategy for the development, the deployment and the use of these technologies in Europe.

The second set of actions aims at improving considerably public support to research and technological innovation. In order to invest in research in Europe, enterprises need to find here abundant and excellent teams of researchers, a strong public research well articulated with industry, and effective public financial support, including through fiscal measures. The action plan focuses on actions to improve the career of researchers, to bring public research and industry closer together, and to develop and exploit fully the potential of European and national public financial instruments. For example, the action plan asks public authorities to eliminate by 2005 the current rules and practices, attached to many public funding schemes, which prevent trans-European cooperation and technology transfer and thus reduce considerably the research and innovation opportunities available to the beneficiaries.

A third set of actions addresses the necessary increase in the levels of public funding for research. Given the current economic downturn, it is all the more important to ensure that budgetary policies favour investments that will lead to higher sustainable growth in the future, among which research is a strong priority. Actions focus on encouraging and monitoring the redirection of public budgets, and on making full use of the possibilities for public support to industry offered by State aid rules and public procurement rules. For example, the action plan proposes to clarify and improve awareness of the types of public support that public authorities can use with no distortion to competition.

Lastly, a fourth set of actions aims at improving the environment of research and technological innovation in Europe: intellectual property protection, regulation of product markets and related standards, competition rules, financial markets, the fiscal environment, and the treatment of research in companies' management and reporting practices. For example, the action plan sets the objective that every student in science, engineering and business should receive at least a basic training on intellectual property and technology transfer.

The action plan marks the start of a process. Progress will be monitored and the Commission and Council will give further orientations in the future, if appropriate, to keep the Union on track. However, there is little time to succeed and the gap is still growing rapidly between Europe and its major trading partners. Implementation must start immediately at all levels, and it must be driven with a clear vision that what is at stake is the success or failure of Europe's ambition to become the most vibrant place for innovation-driven growth and employment creation.

You can find the English, French and German text of this Communication on the Internet at the following addresses:
–http://europa.eu.int/eur-lex/en/com/cnc/2003/com2003_0226en02.pdf
–http://europa.eu.int/eur-lex/fr/com/cnc/2003/com2003_0226fr02.pdf
–http://europa.eu.int/eur-lex/de/com/cnc/2003/com2003_0226de02.pdf

and its annex at:
–http://europa.eu.int/comm/research/era/3pct/pdf/com2002-annex.pdf

2. A call for action

The Barcelona European Council launched in March 2002 a call for action to increase investment in research and technological development[1] and close the gap with Europe's main competitors. Investment in research, the European Council decided, should rise from 1.9% to 3% of GDP in the European Union by 2010, and the share funded by business should rise to two-thirds of the total. Since then all stakeholders have confirmed the relevance of that call and the need to act quickly, on the lines suggested by the Commission communication of September 2002 "More research for Europe: towards 3% of GDP"[2]. The gap in research investment between the European Union and the United States is already in excess of € 120 billion per year and widening fast, with alarming consequences for the long-term potential for innovation, growth and employment creation in Europe. As explained in the September 2002 communication, the gap is linked to less attractive conditions for private investment in research in Europe, due both to lower and possibly less effective public support, and to various obstacles in the wider framework conditions of European research and innovation.

From September 2002 onwards the Commission undertook a wide consultation of European institutions, Member States, Acceding and Candidate Countries, as well as of stakeholders, notably European industry and the financial sector. Responses were overwhelmingly supportive of the 3% objective and of its emphasis on business investment in research. Many replies contained useful insights and proposals that have been used in preparing the present action plan. All Member States, Acceding and Candidate Countries agreed on the importance of increasing investment in research, and most indicated that they had already put in place policies and concrete measures to that effect, or were in the process of doing so. Many have also set national targets in line with the European 3% objective. For example, both France and Germany have adopted the 3% objective for themselves, and so has a future Member State, Slovenia. Momentum is thus building up.

Both the European Economic and Social Committee and the Committee of the Regions supported the 3% objective, as did the Members of the European Parliament who took part in a public debate on that theme.

The numerous detailed replies received from industry and business associations were also unanimously supportive. Many, like the European association of industry (UNICE) and the European Round Table of Industrialists (ERT), stressed that reaching the 3% objective is crucial for Europe's competitiveness but will require major policy changes to restore Europe's attractiveness for research investment. ERT made the 3% objective the main focus of its recommendations to the European Council of March 2003 and UNICE one of its major topics. Associations representing small and medium-size enterprises (SMEs) concurred on the importance of increased investment in research for their constituencies.

A major lesson from the consultation is that large European companies are planning to maintain a significant degree of investment in research despite the current economic slowdown and despite, notably, the sharp downturn in some high-tech sectors. However, as tougher economic conditions make it even more important for these companies to rationalise their global development, they are not planning new research investment in the European Union but rather in other regions that they deem more attractive, such as the United States and some Asian countries. European SMEs, meanwhile, find that their ability to invest in research and innovation is often limited by both reduced auto-financing capacity and more difficult access to external financing. The current economic conditions have further restricted their access to finance for research and technological innovation[3] activities. The economic downturn makes it thus even

(1) "Research and technological development" is hereafter referred to as "research" or "R&D".
(2) COM(2002) 499, 11 Sept. 2002.
(3) "Technological innovation" is hereafter referred to as "innovation".

more important and urgent to focus public action on supporting research and innovation.

According to an econometric study undertaken for the Commission services[4], attaining the 3% of GDP objective for research investment would have a significant impact on long-term growth and employment in Europe, in the order of 0.5% of supplementary output and 400,000 additional jobs every year after 2010[5]. The full impact on growth and employment may be even higher thanks to the boost that additional world-class research will give to the international competitiveness of European industry and services and to Europe's global economic attractiveness. Last but not least, more research in areas of social and environmental interest will help Europe lead the way towards a more sustainable future. As emphasised by the Commission in its report to the March 2003 European Council[6], investing in research is thus at the heart of the strategy set by the Lisbon European Council in March 2000 for Europe's economic, social and environmental renewal.

The European Council of 21 March 2003 called on the Commission to prepare the present action plan and asked the Commission, the Council and Member States to take action on its basis.

The action plan is based on a broad and systemic approach to research and innovation. Both the consultation and supporting studies showed that such an approach is the only credible path to deliver the major increases needed in public and private research investment. Assuming an average EU GDP growth rate of 2% per year until 2010, the targets set in Barcelona (3% and 2/3 from the private sector) require a growth rate of 8% per year for the overall European research effort, shared between a 9% yearly increase for business funding and a 6% yearly increase for public funding.

In order to achieve this, the action plan first addresses the need to **develop a common understanding** shared at all policy levels and by all stakeholders, and to **ensure sustained and coherent progress throughout Europe**. This can notably be achieved by using, where appropriate, an open co-ordination process, European technology platforms and a mutual learning process for European regions, and by designing and implementing policy mixes that combine in a coherent way a broader range of policy instruments. Making the whole of Europe working together is an important issue (see chapter 3).

The action plan then covers successively aspects linked to the effectiveness of public support for research, to the level of public resources made available, and to the improvement of framework conditions:

– **improving the effectiveness of public support for research and innovation**, both financial and in the form of human resources and the public research base (see chapter 4);

– **redirecting public resources towards research and innovation**, through increased attention to public spending quality, adapted state aid rules, better use of public procurement (see chapter 5);

– **improving framework conditions for research and innovation** such as intellectual property rights (IPR), product market regulations, competition rules, financial markets, tax conditions and the corporate management and reporting of research (see chapter 6).

The action plan should be seen in the broader context of the various policy initiatives and the co-ordination process that form part of the Lisbon strategy, notably in the fields of economic and employment policies, enterprise policy, education and training policy, and the internal market strategy. In particular, measures to encourage investment in research must go hand in hand with measures to foster enterprises' motivation to innovate and their capabilities to draw concrete bene-

(4) Study undertaken by the ERASME research team (Paris) with an adapted version of the NEMESIS model (to be published).
(5) This would result notably from major structural changes in the European economy, in particular a shift towards more research intensive and high-growth industries and a considerable increase of the innovation capacity in the European economy.
(6) Commission report to the Spring European Council "Choosing to grow: knowledge, innovation and jobs in a cohesive society", COM(2003) 5, 14 Jan. 2003.

fits from research – measures that are implemented through industrial, entrepreneurship and innovation policies. The recent communication on innovation policy[7] highlights the importance of non-technological forms of innovation[8], identifies the various policy areas having a bearing on enterprises' propensity to innovate, and maps out a route to strengthen innovation policies through co-operation and mutual learning. The pursuit of structural reforms in product, services, capital and labour markets is also important for the creation of a more dynamic and competitive business environment which is conducive to more investment in research and innovation. The action plan addresses specific aspects with a direct bearing on investment in research.

The action plan is supported by a dedicated Website[9] which contains supporting documents and links to other sites devoted to related policies and activities. The site will be enriched and updated continuously, notably to monitor the implementation of the action plan. The annexed working document of the Commission services provides specific elements of information and analyses in support of the action plan.

3. Progressing jointly

Member States are well aware of the need to boost investment in research and they have started putting in place policies and measures to that end. A **European process of co-ordination** is important to ensure that Member States learn from each others' experience and take actions that are mutually consistent. Such a process will also ensure that the European Council can regularly follow the progress achieved towards the objectives it has set.

Sector-specific issues should be taken into account, including through setting specific objectives and milestones in some areas such as information and communication technologies. Increased coherence and co-ordination is needed at the level of the various stakeholders involved in the development and deployment of key technologies in Europe. This can be promoted by **European technology platforms**, bringing together the main stakeholders concerned, in order to set a common strategic agenda addressing research as well as, where appropriate, regulatory and standardisation issues.

Progressing jointly also means that **all regions should be enabled to benefit** from increased research and innovation. Differences and disparities between regions in the enlarged EU are considerable. While some are in a position to maintain or develop technological leadership, others should rather focus on developing the absorption capacities – including applied research and development activity – that will enable them to benefit from world-class research undertaken elsewhere in Europe. However, all regions would gain from more systematic mutual learning in defining their research strategies.

Lastly, administrations at all levels should **develop a systemic view of the various policy dimensions** that need to be mobilised in defining and implementing appropriate policy mixes to foster private investment in research and innovation. These policy mixes involve often different sectors of the public administration, between which co-ordination needs to be strengthened.

(7) "Innovation policy: updating the Union's approach in the context of the Lisbon strategy", COM(2003) 112, 11 March 2003. See also the Commission communication "Industrial policy in an enlarged Europe" (COM(2002) 714, 11 Dec. 2002) and the Green paper "Entrepreneurship in Europe" (COM(2003) 27, 21 Jan. 2003).

(8) Technological innovation must often be combined with other forms of innovation, such as in design, marketing and business organisation, in order to draw the full commercial benefit.

(9) http://europa.eu.int/comm/research/era/3pct/

3.1 FOSTERING THE COHERENT DEVELOPMENT OF NATIONAL AND EUROPEAN POLICIES

An open co-ordination process, as called for by the Spring 2003 European Council, will facilitate mutual learning between Member States in their efforts to increase and improve research investment. It will also help increase the effectiveness of Member States' actions by ensuring, on a voluntary basis, greater consistency with each other and with related Community actions. Lastly, it will organise the data gathering and reporting necessary to enable the European Council to take stock of the progress achieved towards the objective it has set, and assess its efficiency[10].

Taking into account the orientations defined by the Lisbon European Council, application of the open method of co-ordination to the 3% initiative will consist in a collective continuous process of monitoring, a reporting mechanism on national initiatives and progress and an evolving mutual learning, which is:

– geared towards European targets (in this case the 3% and two-thirds objective) translated by Member States into national targets and actions consistent with the overall EU objective and appropriate to their national situations and priorities;

– organised along agreed guidelines (proposed to Member States in the present action plan);

– supported by a set of selected indicators, and by benchmarking exercises on focused topics where there is a particular need for detailed data-gathering and information-sharing and for the identification and dissemination of good practices.

Such an approach should also be applied to the initiatives arising from the human resources implications of the 3% objective, by extending the existing process focusing on the international mobility of researchers to issues involved in the provision of increased and adequate human resources in science and technology.

Complementarity and consistency will be ensured with the mutual learning process on innovation policies outlined in the communication on innovation policy[11].

New actions

- **Set up an open process of co-ordination on actions for increasing investment in research,** involving Member States and acceding countries as well as the candidate countries wishing to participate, based on the light methodology and the set of existing indicators proposed in the annex to the present action plan *(Implementation: Member States and acceding countries with support from the Commission; 2003).*

- **Set up an open process of co-ordination on actions for developing human resources in science and technology,** with particular emphasis on the implications of the 3% objective, as an extension of the existing process focusing on mobility *(Implementation: Member States and acceding countries with support from the Commission; 2003).*

3.2 SHAPING A COMMON VISION FOR THE DEVELOPMENT AND DEPLOYMENT OF KEY TECHNOLOGIES

In some domains research has a vital role to play in addressing major technological, economic, or societal challenges. Here, European technology platforms will provide a means to foster effective public-private partnerships involving as appropriate public research, industry, financial institutions, users, regulatory authorities and policy-makers, and this will deliver the impetus to mobilise the research and innovation effort and facilitate the emergence of "lead markets"[12] in Europe.

(10) See annexed Commission staff working paper.
(11) Op. cit.
(12) See Commission communication "Innovation policy: updating the Union's approach in the context of the Lisbon strategy", op. cit., for a discussion of "lead markets".

In essence, technology platforms will be mechanisms to bring together all interested stakeholders to develop a long-term vision, create a coherent, dynamic strategy to achieve that vision, and steer its implementation. A strategic research agenda will form a crucial part of the strategy to optimise the contribution of research to the process. Technology platforms should also address both the technical and non-technical barriers to and requirements for the optimal development, deployment and use of technologies, such as regulations, standards, financial aspects, social acceptance, skills and training needs, etc., while taking into account the relevant Community policies.

Existing initiatives in areas such as aeronautics and rail transport offer elements of good practice and constitute in effect a first group of European technology platforms. The Commission is planning to set up with relevant stakeholders additional European technology platforms in key areas such as plant genomics, road and maritime transport, hydrogen, photovoltaics, areas of nanotechnologies and information and communication technologies, and steel technology.

New action

- **Set up European technology platforms** on a number of key technologies, following the criteria and methodology indicated in the Commission staff working paper attached to the present communication *(Implementation: stakeholders, with support from the Commission; 2003).*

3.3 ENABLING ALL REGIONS TO BENEFIT FROM INCREASED INVESTMENT IN RESEARCH

A number of past and current initiatives have encouraged regions to develop their own innovation strategies, including research aspects. These initiatives are already proving extremely valuable in raising the awareness of regions about the importance of research and innovation[13] and to help them put supportive policies in place. However, the 3% objective is spurring many new policy developments at European and national levels that need to be reflected in updated and strengthened regional strategies. Moreover, acceding and candidate countries have specific needs, for example regarding infrastructure (already largely in place in current Member States), which need to be taken into account in the development of their own regional strategies.

New action

- **Establish a mutual learning platform** to help regions in the further development of their research strategies, taking into account their specific situation and needs. Building on existing activities, the platform will be supported notably by the development of a typology of regions, a methodology for the comparative assessment of regional performance, and specific actions to promote the use of science and technology foresight at regional level *(Implementation: Commission-supported process with regions; 2004).*

3.4 DESIGNING A COHERENT MIX OF POLICY INSTRUMENTS

Firms will invest more in research only to the extent that they can draw concrete commercial benefit from the results. They must have access to an adequate supply of quality human resources and to a stronger and more responsive public research base. Increased and more effective public support is necessary and it must be accompanied by much more favourable framework conditions, such as adequate intellectual property right systems, a competitive environment with research and innovation-friendly regulations and competition rules, supportive financial markets and a favourable fiscal environment.

The Commission's recent communications on industrial policy, entrepreneurship and innovation

(13) See annexed working document of the Commission services.

policy[14] complement the present action plan in pointing the way towards a more competitive business sector willing to invest in and benefit from research.

As remarked in a recent report to the Commission[15], "the scale of the structural changes needed to transform the EU into a research-intensive, high-tech, knowledge-based economy make it highly unlikely that any single route – in isolation – will be enough." Clearly, a broader range of policies and instruments will need to be mobilised and co-ordinated more closely than has been the case until now to stimulate increased private investment in research and innovation. The broader policy mixes that are required should optimise the use of various financial support instruments and combine them with measures to improve framework conditions. The design and implementation of appropriate policy mixes at EU, national and regional levels is thus a key challenge for public authorities. The optimal design of these policy mixes depends on the specific strengths and weaknesses of national or regional research and innovation systems, as well as on taking into account, where appropriate, sector-specific issues. It requires effective co-ordination between the various departments or ministries concerned.

The following action is thus essential to the effective development of national policies in support of research and innovation. The Commission is applying this approach in developing its own policies and will support Member States applying it through the open method of co-ordination.

New action

- Improve the effectiveness of public actions to promote research and innovation by **designing policy mixes using in a coherent way various policy instruments, and by developing the interactions with policies put in place by other countries and at European level**, notably on the basis of information shared and lessons learned through the open process of co-ordination *(Implementation: all levels, with Commission support for the open process of co-ordination).*

4. Improving public support to research and innovation

Industry reactions to "More research for Europe"[16] showed unambiguously that the main factors considered by firms when deciding whether and where to invest in research, are the availability of abundant and excellent researchers and research personnel, a vibrant, world-class public research base, improved public financial incentives, and a much more favourable regulatory environment. This chapter focuses on the need to expand and improve human resources, to strengthen the public research base and to enhance the effectiveness of the various public financing instruments.

4.1 HUMAN RESOURCES

More and adequately skilled researchers will be needed in Europe in order to attain the targeted increase of investment in research by 2010. Increased investment in research will raise the demand for researchers: about 1.2 million additional research personnel, including 700,000 additional researchers, are deemed necessary to attain the objective[17], on top of the expected replacement of the ageing workforce in research. It has also to be considered that such an increase will have to face

(14) Op. cit.
(15) Report to the Commission of the independent expert group on "Raising EU R&D intensity: Improving the effectiveness of the mix of public support mechanisms for private sector research and development", April 2003.
(16) Op. cit.
(17) In head count. These are orders of magnitude, the precise results depending on hypotheses retained. There were about 1.6 million researchers in Member States and acceding countries in 2000.

general demographic pressures[18], the stagnation of student enrolment in a number of scientific disciplines and international competition to attract highly qualified workers. Thus, the adjustment of human resources to the prospective needs for research and innovation will imply combined and greater efforts from all the stakeholders in order to: attract a sufficient number of world-class researchers in Europe; make research more attractive to various categories of the population, especially women[19]; and reduce losses at the various stages of education and during the research career, including at the most experienced stage. This implies addressing research-related issues in a number of policies, especially labour market, employment, education and training, and immigration-related policies. Although general measures should be preferred whenever possible, the scale and urgency of the challenge regarding the need for researchers make it necessary to envisage temporary specific measures.

Strengthening the human resources in research thus involves a combination of initiatives at national, regional and Community levels aiming at:

– attracting more students to research, in particular through the increase in financial incentives, the Science and Society initiatives, and the facilitation of student mobility;

– attracting international researchers to Europe and fostering mobility between the academic world and industry;

– maintaining researchers in the profession and in the European research area by giving favourable career development prospects and a positive image of the researcher's profession.

Main ongoing initiatives relevant to the 3% objective

- Implementation of the Mobility strategy for the European research area, especially initiatives aiming at improving access to the European research labour markets, such as the launching of information tools for researchers, the full application of the co-ordination of social security schemes, including the improvement of the take up of complementary pensions, and the implementation of the European health insurance card.

- Implementation of the Science and Society action plan, notably actions to promote the mainstreaming of gender equality and the launch of an initiative to enhance science teaching and bridge the gap between science education and working with science.

New actions

- **Develop proposals on the career of researchers** aimed at facilitating the opening of national systems for the recruitment, evaluation and further career development of researchers at European and international levels, including the need for a specific regulatory framework *(Implementation: Commission communication 2003, Member States).*

- Examine the case for **further European or concerted measures to substantially enhance the conditions for researchers in the EU**, in the framework of the open process of co-ordination *(Implementation: Commission and Member States, starting 2003).*

- **Adopt and implement the foreseen proposals for an action plan and a directive on the conditions of entry and stay of third-country nationals for the purpose of research in the EU** *(Implementation: Commission proposals 2003).*

(18) The active population is expected to have fallen by 9 million by 2010.
(19) The potential for increasing the number of women researchers is considerable since the proportions of women in researchers in the public and private sectors are respectively 31% and 15%.

4.2 PUBLIC RESEARCH BASE AND ITS LINKS TO INDUSTRY

The links between industry and public research (either from university or public research organisations) are evolving from a dominance of 'sponsorship', in which companies funded public researchers to solve specific problems, towards more structured forms of partnership aiming at sustained, long term interaction. There is a growing awareness that public research institutions can be valued partners providing complementary expertise, knowledge and resources that are often unavailable within the industrial community. Such partnership offers a potentially powerful tool to make investment in research more attractive to business while also benefiting public research.

However, in Europe we are still at the beginning of the process. Many companies still see public research merely as a source of basic knowledge and highly-trained students. When it exists, the partnership process is not always managed properly. All in all, there is a widespread perception in Europe of a continuing gap between the respective performances of academic research and technology-based innovation.

Main ongoing initiative relevant to the 3% objective

- Initiatives to be derived from the consultation on the Commission communication "The role of universities in the Europe of knowledge", particularly on how to establish closer co-operation between universities and enterprises.

New actions

- Pursue or initiate necessary **regulatory and administrative reforms, and support measures, to enable public research institutions to develop more effective links with industry**, in particular SMEs, while safeguarding their public mission in education and fundamental research. Issues to address include notably the establishment of incubators, science parks, seed funds and new types of public-private partnerships and the performance appraisal of researchers *(Implementation: Member States)*.
- **Increase the participation of industry and other stakeholders in the determination of priorities for public research** *(Implementation: all levels)*.
- Develop **guidelines to help Member States review – and, where appropriate, adapt – their national regimes governing the ownership, licensing and exploitation of intellectual property rights (IPR) resulting from publicly-funded research**, with the aim of promoting technology transfer to industry and spin-off creation *(Implementation: Commission with Member States; 2004)*.
- Develop **European guidelines for the management and exploitation of IPR in public research institutions and public-private partnerships**. These guidelines will help public research institutions to develop and enforce, on a voluntary basis, charters setting out the main principles to be applied regarding e.g. the ownership and licensing of research results, the sharing of revenues, etc. *(Implementation: Commission in co-operation with stakeholders; 2004)*.

4.3 IMPROVING THE MIX OF PUBLIC FINANCING INSTRUMENTS AND THEIR EFFECTIVENESS

Increasing public support to research and innovation goes hand in hand with improving its effectiveness, in particular its leverage effect on private investment. There is scope for making a more effective use of the various public financing instruments, individually and in combination: direct measures, fiscal incentives, guarantee schemes, support of risk capital. A mix of instrument is needed as no single instrument can address optimally the needs of all segments of industry. Direct measures and fiscal incentives can be used for large firms as well as SMEs, while guarantee and risk capital schemes concerns mainly SMEs.

Public financing instruments must be developed and used with due respect to competition rules, notably art. 87 of the Treaty (CE), as well as, in the case of fiscal measures, with due respect for Member States' commitments in the EU tax arena, notably the Code of conduct for business taxation.

4.3.1 Mix of financing instruments

The main challenge at European level is to reinforce the respective roles of the major financial instruments and their complementarity in support of research and innovation: the Sixth research framework programme (FP6), the structural funds, Eureka, and the financial instruments of the EIB Group[20]. The possibility should also be explored of gearing part of the interventions of the European Bank for Reconstruction and Development (EBRD) in acceding and candidate countries to support industrial investment in research and innovation. Member States should also seek to optimise their mix of instruments taking into account the characteristics of their research and innovation systems as well as experiences in other countries and developments at European level.

Main ongoing initiatives relevant to the 3% objective

- Further development of complementarity and synergies between European financing instruments: the Sixth research framework programme, structural funds, EIB/EIF and Eureka (joint working groups).
- Effective implementation of the Sixth research framework programme, in particular to foster excellence and integration of resources, as well as cooperation between national programmes (ERA-Net scheme).
- Mid-term review of the structural funds instruments, highlighting the potential benefits for regions of actions under the research and innovation priority.
- Launch of the 'innovation 2010' initiative of the EIB Group, as the follow-up to its innovation 2000 initiative, with increased means (investment target of € 20 billion for 2003-2006) and improved instruments to invest in research and innovation activities.

New actions

- **Develop the research and innovation priority as a major axis of the structural funds after 2006** *(Implementation: Commission 3rd Cohesion report; 2003).*
- **Streamline funding of collaborative projects in the frame of Eureka** by examining possible options, in particular ways to synchronise national support[21] or to create a common financing scheme *(Implementation: Eureka Member States).*
- **Optimise the mix of financing instruments**, taking into account the needs for different industry segments and developments in other countries and at European level *(Implementation: Member States).*
- Develop **co-operation between the Sixth research framework programme and the European Bank for Reconstruction and Development**, on the model of the successful co-operation set up with the EIB Group *(Implementation: Commission and EBRD; starting in 2003).*

4.3.2 Direct measures for research and innovation

Direct funding, usually in the form of grants[22], remains the preferred type of public support to business research in most countries. Grants allow public authorities to finely target specific technologies or scientific areas, overcoming cyclical or sectoral slowdowns. They can also influence recipients' behaviours through the conditions attached to them, for example to encourage the development of partnerships and technology transfer.

Important issues are how to promote the constitution of a critical mass for research in key areas, as national capacities are more and more

(20) Includes the European Investment Bank (EIB), which implements loan instruments, and the European Investment Fund (EIF), which manages equity and guarantee instruments.
(21) Grants, loans or guarantee schemes.
(22) Conditional grants or loans, although used less often than grants, are also direct measures; reimbursement is linked to success or failure of commercial exploitation.

often proving insufficient to create world-class poles of excellence; how to ensure the participation of SMEs, which is crucial to boost the innovative capacity of large segments of the economy; and how to ensure that the results of publicly-funded research are fully exploited[23].

New actions

- **Eliminate rules and practices in national programmes that impede European co-operation and technology transfer**[24], and **allow funding of organisations from other Member States** where appropriate *(Implementation: Member States; proposed target: 2005)*.
- Gear more research programmes towards the **constitution of poles and networks of excellence** by encouraging clustering or integration of resources at regional, national and European levels *(Implementation: all levels)*.
- **Enhance the innovation impact of R&D programmes by encouraging and supporting the integration of innovation-oriented activities in research projects** (e.g. knowledge management and diffusion, training activities, take-up measures for SMEs) *(Implementation: all levels)*.
- Consider setting **targets for the participation of SMEs** in national programmes, on the model of the 15% target set in the Community research framework programme *(Implementation: Member States)*.
- Develop a **European agenda for advanced research relating to global security, and launch a preparatory action in view of the possible setting up of a European structure to procure security-related research of common interest**, following the Commission communication on the defence equipment industry and the European Council conclusions on the subject *(Implementation: Commission with Member States)*.

A possible European initiative for the acquisition of defence research, as suggested by the European Council of March 2003 following the Commission communication on the defence equipment industry, would also increase the effectiveness of European defence R&D efforts and could lead to increased funding of frontier technologies of dual-use interest.

4.3.3 Fiscal measures for research

Fiscal incentives are increasingly used to encourage business research as they can support a wide population of firms, including SMEs, while leaving enterprises a maximum of independence. To be

New actions

- Encourage **a concerted use of fiscal incentives to address research policy issues of common interest**, notably to:
  - **Encourage the creation and early growth of research-intensive firms;**
  - **Facilitate fund raising by new or existing foundations supporting R&D activities in Europe**.
- Consider also such a concerted use of fiscal incentives to **raise the attractiveness of research careers**. *(Implementation: Commission with Member States in the context of the open method of co-ordination; progress report in 2004)*.
- **Improve fiscal measures for research** on the basis of:
  - formal evaluations, whose results should be disclosed;
  - mutual learning;
  - the application of principles of good design such as simplicity, low administrative cost and stability;

  (Implementation: Member States).
- **Disclose data on the budgetary cost of fiscal measures** *(Implementation: Member States)*.

(23) See report to the Commission of the independent expert group on "Raising EU R&D intensity: improving the effectiveness of public support mechanisms for private sector research and development: direct measures", April 2003.

(24) For example restrictions on the use of the results in other countries and on sub-contracting to non-national organisations. Moreover, even when national programmes have no formal rules excluding projects involving collaboration with organisations from other countries, the absence of an explicit statement guaranteeing the eligibility of such projects is often perceived negatively due to past practices in the attribution of funds.

effective, fiscal measures for research should be designed with care and co-ordinated with other research support instruments. Although optimal design depends on the country-specific context, notably the general national fiscal system, there is scope for mutual learning. For example, a recent review of tax incentives for business research[25] suggests that volume-based schemes, although more costly, may be more effective than incremental schemes in stimulating increased research expenditure, in particular in periods of economic downturn; that an important feature may be to make the fiscal scheme independent of profitability, through carry forward/carry back facilities or cash refunds if companies make losses; and that a clear definition of eligible activities is essential, and should preferably include outsourced research as well as in-house activities.

4.3.4 Support to guarantee mechanisms for research and innovation in SMEs

The purpose of guarantee schemes is to share risks between different stakeholders. They may cover either equity investment of venture capital funds or loans and are particularly appropriate for supporting the financing of SMEs, with a high leverage effect on private finance. Equity guarantees could be used to support the creation and early growth of technology-based firms, while loan guarantees would be more appropriate for the financing of research or innovation projects in established SMEs with a limited risk profile.

Public support for such schemes is well developed, notably at the European level by the European Investment Fund (EIF), whose SME guarantee facility has benefited some 120,000 SMEs since 1998. This support is typically offered through sharing the cost of guarantees (co-guarantee) or counter-guaranteeing them. However, despite well-identified market failures in the financing of research and innovation, the potential of guarantee schemes for supporting specifically research and innovation activities appears still largely unexploited in most Member States. Therefore, a better use of such schemes should also be considered and promoted where appropriate, including innovative tools such as the inclusion of guarantees in a larger integrated package of services and the securitisation of loan pools[26].

New actions

- On the basis of experience in some countries, **make better use of guarantee mechanisms to improve access to debt and equity financing for research and innovation activities in SMEs** *(Implementation: all levels)*.
- Consider strengthening and extending future guarantee schemes managed by EIF from its own resources or the community mandate, in order to support the **development of national and regional guarantee programmes to improve access to debt and in particular equity financing for research and innovation in SMEs** *(Implementation: EIB Group and Commission)*.

4.3.5 Support to risk capital for research-intensive SMEs

Research-intensive SMEs tend to rely more than others on risk capital for their start-up and early growth, as their auto-financing capability is very limited compared to the size of their research investment needs and their access to credit is restricted by the perceived risk associated with research. The dramatic decline of risk capital activity since 2000 makes it particularly difficult for young research-intensive SMEs to grow or even survive in

Main ongoing initiative relevant to the 3% objective

- Networking activities for risk capital fund managers and business angels, encouraging the emergence of trans-European co-ordinated risk capital activities.

(25) See report to the Commission of the independent expert group on "Raising EU R&D intensity: improving the effectiveness of public support mechanisms for private sector research and development: fiscal measures", April 2003.

(26) See report to the Commission of the independent expert group on "Raising EU R&D intensity: improving the effectiveness of public support mechanisms for private sector research and development: guarantee mechanisms", April 2003.

current conditions. Considering the market failure to raise adequate funding for seed and early stage capital and the cyclical factors that have led to the current funding gap in subsequent stages, there is a strong case for public support for seed and early stage capital, as well as for a wider, time-limited public support to venture capital markets[27]. Public measures should also address awareness issues.

New actions

- **Strengthen and broaden EIF risk capital activities to better address market failures and current equity gaps** (seed and early stages, including incubators and funds established jointly by networks of universities, and for a limited period the equity gaps in subsequent rounds), **and to extend to public research organisations its advisory services on the setting up of new funds** *(Implementation: EIF and Commission).*
- **Increase awareness of research-intensive SMEs about appropriate use of risk capital** notably through actions at regional level, in accordance with the Commission guide on risk capital financing *(Implementation: all levels).*

5. Redirecting public spending towards research and innovation

Increasing the quality of public support for research will contribute to raising the level of private investment significantly. Its is, however, not sufficient. There is also a need for more public investment in support of research. The following sections examine this in the light of the stability and growth pact and the broad economic policy guidelines, of State aid rules, public procurement, and the financial perspectives for the European Union.

5.1 THE STABILITY AND GROWTH PACT AND THE BROAD ECONOMIC POLICY GUIDELINES

The recent Commission proposals for strengthening the co-ordination of budgetary policies[28] confirmed that the quality of public finances, under the angle of their contribution to growth, is an integral part of budgetary surveillance within the context of stability and convergence programmes. In this

Main ongoing initiatives relevant to the 3% objective

- Implementation of the Stability and growth pact, particularly the more detailed assessment of the quality of public spending proposed by the Commission communication of November 2002 on the co-ordination of budgetary policies.
- Adoption by the Council and follow-up of the Commission recommendations for the Broad economic policy guidelines 2003-2006, particularly regarding the quality of public spending and its refocusing towards knowledge, notably research and innovation.

(27) See report to the Commission of the independent expert group on "Raising EU R&D intensity: improving the effectiveness of public support mechanisms for private sector research and development: risk capital measures", April 2003.
(28) COM(2002) 668, 27 November 2002.

regard, the Commission has repeatedly made the case for refocusing public spending towards more productive investments, notably in support of research and innovation, since they are conducive to higher growth in the future. In order to ensure macroeconomic stability and long term sustainability of public finances, this must be done within the framework of the stability and growth pact. Increased public support for research and innovation is one of the categories of spending in support of the Lisbon objectives, for which the Commission considers that small and temporary public deficits should be authorised in countries having otherwise attained a positive or close to balance budget position. The current economic downturn makes it all the more important to ensure that budgetary policies favour investments that will lead to higher sustainable growth in the future.

Consistent with this approach, the Commission's proposal for the broad economic policy guidelines 2003-2006 recommends to refocus public spending towards more productive investment, particularly research and innovation, and translates this priority into a number of specific recommendations to Member States[29].

New action

- **Encourage and monitor the refocusing of public spending towards knowledge, notably research and innovation** *(Implementation: all levels).*

5.2 BALANCE BETWEEN NATIONAL AND EU PUBLIC FUNDING UNTIL 2010

The financial means available from the European Union budget to support research and innovation should be examined in relation to the efforts undertaken at national level. Clearly, given the long-term common target of 3% of GDP for research expenditure, the respective roles of public expenditures at EU and national should be assessed as soon as possible in co-operation with Member States and acceding countries.

New action

- **Analyse and discuss with Member States and acceding countries the public budget requirements** for attaining the 3% objective and the repartition of roles and efforts between national and Community levels until 2010 *(Implementation: Commission with Member States and acceding countries, in the context of the open method of co-ordination).*

5.3 STATE AID RULES

Many forms of public support to research cause no distortion to competition and therefore do not constitute State aid. This type of support should be encouraged in priority. However, a large proportion of public support to business research still falls within the State aid category. The Community framework for State aid for R&D aims at striking a balance between the need to ensure on the one hand that distortions of competition are kept to the minimum and on the other that European industry becomes more competitive. Public support is justified by the recognised failure of the market to induce business investment in research at an optimal level. The framework was renewed in 2002 until 2005 as the maximum levels of aid authorised were not considered an obstacle to the achievement of the 3% target. However, as by the end of 2005 the current

Main ongoing initiatives relevant to the 3% objective

- Rapid adoption of a revised block exemption for SMEs, encompassing State aid for R&D.
- Collection of data and reporting on the redirection of State aid towards horizontal objectives, including research.

(29) See notably recommendations 13 and 14 of the Commission's proposal for the broad economic policy guidelines, COM(2003) 170, 8 April 2003.

framework will have been in force for nearly ten years, it will be necessary to review the basic definitions and concepts used to take account of subsequent developments in R&D.

Block exemption regulations alleviate the burden of notifying certain types of State aid and hasten the granting of support to industry. The Commission intends to amend the existing block exemption for State aid to SMEs, widening its scope to both individual R&D aid and R&D aid programmes, which will considerably reduce the number of notifications. The possibility of a further block exemption will be considered within the review of the Community framework on State aid for R&D.

New actions

- **Clarify and improve awareness of the forms of public support to research that cause no distortion to competition and therefore do not constitute State aid** *(Implementation: Commission).*
- **Prepare the revision of the Community framework on State aid for R&D**, notably through in-depth review of the following issues:
  - the definition of the cut-off point between research activities eligible for public support and pure commercial innovation activities and differentiation between eligible R&D projects according to their proximity to the market;
  - changes in the role of public research establishments towards stronger co-operation with industry;
  - the various models of public support for R&D activities used by the Community's major trading partners and their implications in terms of a level playing field for European enterprises acting on global markets.

  Within the review of the framework, the possibility of block exempting aid will be considered *(Implementation: Commission).*
- **Redirect State aid towards R&D** as part of the more general redirection of State aid towards horizontal objectives *(Implementation: all levels).*

5.4 PUBLIC PROCUREMENT

Public procurement is estimated to represent 16% of European GDP. It is a leading or major component of demand in a number of sectors, such has health care, education, transport, environmental protection and defence where the public sector can act as a launching customer[30]. Procurement rules and practices should aim at ensuring that public buyers get the best value for money. Part of this means ensuring that public buyers are able to get products and services with the technology that best fits their needs, including innovative products and services when this is justified. Various possibilities already exist, and the procurement legislative package currently in the process of adoption will clarify and expand them in some respects: for example, with its emphasis on performance and definitions of technical specifications, and with the "competitive dialogue" procedure, allowing to organise competition for complex contracts in dialogue with suppliers so as to identify one or more technical solutions before the final award. Other possibilities may lie with e-procurement and the related dynamic purchase system.

An important objective is to raise public buyers' awareness of the possibilities offered to them by the legislative framework, and to support the development and diffusion of information enabling them to make full and correct use of these possibilities. This could have a significant impact on the procurement of more innovative products and services, thereby stimulating further research and innovation.

(30) Through public procurement, in particular in the defence sector, the US government acts as a "launching customer" for innovative technologies (in particular information and communication technologies) and lowers the risk for subsequent customers. In Europe, the European satellite navigation system Galileo is a good example of a large European initiative where initial public procurement plays a major role in the development of the core technologies, followed by a public private partnership for the deployment and exploitation of the infrastructure.

Main ongoing initiatives relevant to the 3% objective

- Rapid adoption of the procurement package by the Parliament and Council.
- Progress of the e-procurement initiative.
- Awareness-raising actions proposed in the recent Commission's communication on innovation policy.
- Progress towards the possible creation of a European intergovernmental defence capabilities development and acquisition agency.

New action

- **Support the development and diffusion of information**, for example on the best available technologies for key categories of products, enabling public buyers to procure technologies that best fit their needs, in particular in sectors such as health, environment, transport and education where they are often first customers *(Implementation: all levels)*.

6. Improving framework conditions for private investment in research

While more and better public support is necessary to boost research and innovation in Europe, this needs to be accompanied by considerable improvements in the wider framework conditions to make the European Union really attractive for private investment in research and innovation. A number of recent breakthroughs need to be confirmed and new actions are needed in areas such as intellectual property (IP), market regulations, competition rules, financial markets, fiscal conditions and corporate reporting on research.

6.1 INTELLECTUAL PROPERTY

The protection of intellectual assets is important to the competitiveness of most organisations, private or public, and to their attractiveness for investors. In particular, there is a need for properly balanced intellectual property systems, offering suitable incentives to innovate and invest in research, while at the same time ensuring that the diffusion and further development of research results are not stifled. Considerable progress has been achieved in recent years, at international and Community levels, such as the adoption of the unitary Community design right becoming effective in 2003 and the recent political agreement on the creation of the Community patent system. However, there is still scope to make European intellectual

Main ongoing initiatives relevant to the 3% objective

- Setting up of the Community patent system.
- Negotiation of a proposal for a directive on the enforcement of intellectual property rights.
- Negotiation of a proposal for a directive on the patentability of computer-related inventions, taking into account the need to avoid stifling competition and open-source development.
- Rapid implementation of Directive 98/44/CE relating to the patentability of biotechnological inventions and Directive 2001/29/CE relating to copyright and related rights in the information society.
- Promotion of a common European approach on the grace period issue, in the context of international harmonisation work.
- Use of existing instruments in the research framework programme to support temporary exchanges of technology transfer professionals between research organisations.

property systems more responsive to the rapid evolution of both research processes and specific technological areas. In addition, actions are needed to promote the optimal use of intellectual property rights systems in Europe, with a special emphasis on academic institutions and smaller businesses.

New actions

- Support **EU-wide coordinated IPR awareness and training activities** targeting in particular the European research community *(Implementation: Commission and other relevant institutions).*
- **Assess specific research-related aspects of IP law**, including the experimental exception, prior user rights, legislation applicable to technological know-how, and IPR co-ownership provisions, with a view to identifying necessary actions where appropriate *(Implementation: Commission with stakeholders; progress report in 2004).*
- Ensure that before graduating, every student – especially from science, engineering and business schools – receives **basic awareness/training regarding intellectual property and technology transfer** *(Implementation: Member States and higher education institutions).*

6.2 REGULATION OF PRODUCTS AND STANDARDISATION

The impact on research and innovation of existing and new regulations of markets should be checked and optimised where necessary. This should be done in a way consistent with the "better regulation" initiative and notably the Commission's new impact assessment framework. From a research and innovation point of view, an important objective is to ensure that regulations remain technology-neutral. A good example is the so-called "new approach", which limits itself to the requirements that are essential to protect the public interest and leaves the technical expression of these requirements to be drafted in the context of the European Standards Organisations (CEN, CENELEC, ETSI) by means of consensus-based standards. This approach has very positive effects on research and innovation by ensuring such technology-neutrality as well as the necessary balance of flexibility and legal certainty. It also means that attention should focus on a timely, effective, open and transparent standardisation process which, like regulation, should remain technology-neutral by relying on performance indicators. Aspects regarding the European standards policy will be examined in details in a Commission communication later this year. The two following aspects are particularly relevant to

Main ongoing initiatives relevant to the 3% objective

- Forthcoming Commission communication on standardisation.
- Implementation of the General guidelines for co-operation between the European Standards Organisations and the European Commission[31].
- Use of the Sixth research framework programme to fund research necessary for standardisation purposes, in particular in the context of integrated projects and networks of excellence.

New actions

- **Identify technological areas where existing legislation or the lack of legislation is an impediment to the development and deployment of new technologies**; define, where appropriate, measures to address the problems; this will notably be undertaken in the context of European technology platforms *(Implementation: Commission with stakeholders).*
- **Strengthen the links between the Sixth research framework programme and European standardisation organisations** (CEN, CENELEC and ETSI) with the view of defining and supporting where appropriate research that is required for the development of European standards *(Implementation: Commission and European standardisation bodies).*

(31) To be published in OJEC.

research and innovation: first, resources need to be made available to fund the research required for completing the development of many European standards; secondly, adequate awareness of standards is needed to allow European business, notably SMEs, to take them better in account in their research and innovation projects.

6.3 COMPETITION RULES

In addition to the review of the Community framework for State aid to R&D, European competition rules are currently being revised in ways allowing for research and innovation aspects to be better taken into account when assessing market dynamics and competitive conditions. Notably, the recent overhaul of EU anti-trust law gives more emphasis to economic assessment. In this context, the forthcoming revision of the block exemption and guidelines for technology transfer agreements should lead to a less legalistic process focusing more on economic assessment. The effects of research and innovation activities also need to be more explicitly considered in merger decisions, in line with the Merger regulation which foresees that "the development of technical progress" should be taken into account[32].

Main ongoing initiative relevant to the 3% objective

- Forthcoming revision of the block exemption and guidelines for technology transfer agreements (external consultation planned during autumn 2003).

New action

- Develop **guidance on how the potential efficiencies through technological progress will be assessed in merger decisions** *(Implementation: Commission).*

6.4 FINANCIAL MARKETS

Efficient, supportive and integrated financial markets are a major enabling factor to foster investment in research, notably by technology-based SMEs at the various stages of their development. Key markets involved are risk capital markets at start-up and growth stage, secondary markets for the financing of initial public offerings and subsequent expansion, and debt markets. Particularly important issues for research and innovation are the full implementation of the financial services action plan, in particular aspects such as the integration

Main ongoing initiatives relevant to the 3% objective

- Full implementation of the financial services action plan.
- Rapid completion of the risk capital action plan, and elaboration of follow-up actions as appropriate.

New actions

- **Adapt, where appropriate, the fiscal treatment of risk capital to avoid the double taxation of investors and funds**[33] *(Implementation: Member States)*; to that effect, consider also the merits and the possibility of developing an **harmonised European fund legal structure** ensuring tax transparency for risk capital operations throughout the Union *(Implementation: Commission with relevant stakeholders).*
- In the light of the recent dramatic decline of risk capital financing world-wide, and of the particularly important role of banks in risk capital financing in Europe, **ensure that Community legislation on capital adequacy, which will be based on the future Basel II capital agreement, properly takes into account the needs of risk capital providers** *(Implementation: Commission; legislative proposal in 2004).*

(32) Article 2(1)(b).

(33) Double taxation (investors and funds) reduces the profitability of investment in risk capital funds compared to investments made directly in firms, and therefore diminishes the attractiveness of such funds. This restricts investments by both domestic and international investors.

(34) Historical financial statements are not a reliable guide to future performance of technology-based firms, because these companies frequently enter new markets with new products. Technology rating looks forward, by helping to assess the value of an innovative technology-based product or service.

- Examine ways to **promote the use of rating systems that include technology risk assessment** (technology rating)[34] to enable potential investors to appraise the specific risks and rewards associated to **investments in technology-based SMEs** *(Implementation: all levels, including Commission, with relevant stakeholders; report in 2005).*

of capital markets in Europe, and the emergence of rating mechanisms appropriate to technology-based companies, including SMEs.

Equally important is the rapid completion of the risk-capital action plan and its possible follow-up. Notably, the tax and regulatory environment of risk-capital should be considered in this context, as investors, especially institutional investors, are highly sensitive to costs and complexity and likely to divert their investments to other asset classes unless the conditions of investment in risk capital are substantially improved. Particular attention should be given to double taxation issues, as well as to the possibly damaging effects of excessive prudential obligations imposed on banks and other financial institutions.

6.5 FISCAL ENVIRONMENT

Ongoing actions by the Commission to promote a fair and efficient European fiscal environment is likely to have a significantly favourable effect on the attractiveness of the EU for research investment and innovation. The Commission is following a two-pronged strategy for tackling the tax obstacles to cross-border activities in the internal market: in the short term, enactment of specific legislation targeted at each particular obstacle; in the longer term, development of a systematic, comprehensive solution to all cross-border issues providing companies with a common consolidated tax base for their economic activities within the EU. Actions of particular importance for research investment are listed below.

Main ongoing initiatives relevant to the 3% objective

- Forthcoming Commission initiative on the cross-border offsetting of losses for tax purposes (planned in 2004), which will benefit research activities and contribute to their more efficient allocation within multinational groups, since these activities are almost by definition accounted as loss-making.
- Work of the EU joint transfer pricing forum, to improve notably the tax treatment of transactions between various units of multinational companies (e.g. transfer of intangibles).
- Rapid adoption of the draft directive on the taxation of cross-border payments of interest and royalties, which will abolish withholding taxes on royalties for patents in the EU.
- Progress towards creating a consolidated EU tax base for companies, on the basis of the forthcoming Commission communication planned for the end of 2003.

6.6 CORPORATE RESEARCH STRATEGY, MANAGEMENT AND FINANCIAL REPORTING

There is room for progress in increasing awareness of companies, especially SMEs, of the benefits and ways of integrating research and innovation into their business strategy and management. This awareness can be raised by the education system and also by new methods of financial reporting. Within the curricula of business schools more attention should be paid to an integrated approach to R&D management within the overall business strategy. Creating more transparency in financial reporting about the role of investment in research and other forms of intellectual capital will also lead to a better understanding of value creation within companies and provide a better basis for decision-making to managers and investors. Regarding external company financial reporting, more attention should be paid to the implementation of guidelines, consistent with new International Accounting Standards, concerning

reporting of R&D and other forms of intellectual capital. These new types of reporting will also provide data, which will enable statistical offices to provide better information on the size of investment in intellectual capital.

Main ongoing initiatives relevant to the 3% objective

- Actions within the research framework programme to stimulate widespread use and harmonisation of guidelines on measuring corporate research and other forms of intellectual capital.
- Development and regular publication of statistics on firms' investment in intellectual capital.

New actions

- Set up an **industrial research monitoring activity, including a score-board**, to analyse trends and facilitate benchmarking of research investment and research management practices between firms, building on experience in Member States *(Implementation: Commission support; first report early 2005).*
- Encourage **corporate measuring and reporting on research and other forms of intellectual capital**, both internally and externally, making use of existing international guidelines. *(Implementation: business sector).*
- Encourage **the development and inclusion of state-of-the-art R&D management modules into science, engineering and business schools curricula** *(Implementation: Commission with higher education institutions and industry).*

7. Conclusion

The present action plan marks the start of a process which has the potential to boost Europe's attractiveness for investment in research and to put the Union on track for reaching the objective of 3% of GDP for research by 2010. However, this requires determined and coherent action by Member States, acceding and candidate countries and all stakeholders. For its part, the Commission will start immediately taking the necessary steps to advance along the lines identified above and to encourage those that are willing to improve the conditions to do more and better research in Europe. It will also report every year ahead of the Spring European Council meeting so that the European Council may follow progress and set further orientations or adjust its strategy as appropriate on the basis of progress made.

Annex

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Introduction

This working paper of the Commission services complements and supports the Communication "Investing in Research: an action plan for Europe". It comprises 7 sections addressing the following topics:

– the importance of R&D[1] investment for growth;

– developments in national policies towards the Barcelona objective (Member States, Acceding and Candidate Countries);

– the positive response of the business sector to the first Commission Communication on the Barcelona objective;

– the contributions of the 6th Framework Programme to the Barcelona objective;

– the approach proposed for the application of the open method of co-ordination to the Barcelona objective;

– European technology platforms;

– supply chain of human resources for R&D.

(1) Hereafter referred to in the text as "research" or "Research and Technological Development – (RTD).

1. Investment in R&D and growth

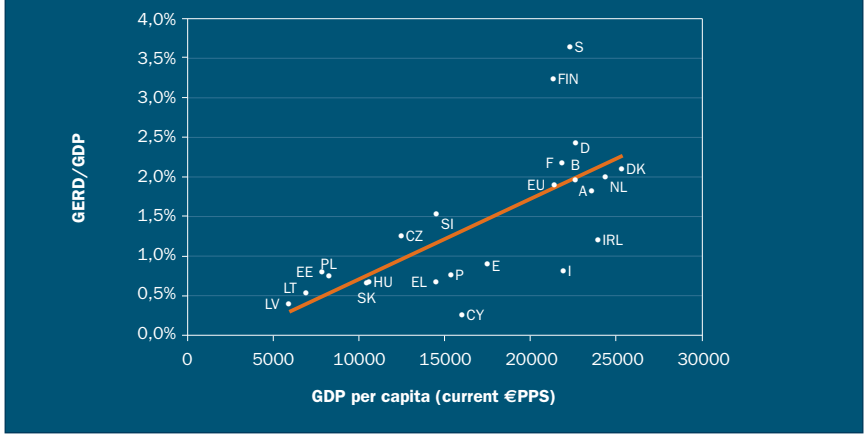
There is a strong correlation between national R&D intensities and Gross Domestic Product (GDP) per capita as evidenced in **Figure 1.1** which indicates Gross domestic Expenditure on R&D (GERD) as a percentage of GDP against GDP per capita for year 1999. R&D intensities span from 0.25% in Cyprus to 3.65% in Sweden (1999).

The correlation between R&D intensities and regional GDP per capita still holds at regional level as evidenced in **Figures 1.2 and 1.3**, which show that large disparities also exist between regions of the same country.

The dispersion of R&D intensities for regions with similar GDP per capita becomes more apparent the smaller the scale of analysis. At NUTS(2) 1 level – immediately below countries - R&D intensities range from 0.5% to close 4%. At NUTS 2 level; the span of R&D intensities further widens to less than 0.2% to more than 6%.

Figure 1.1

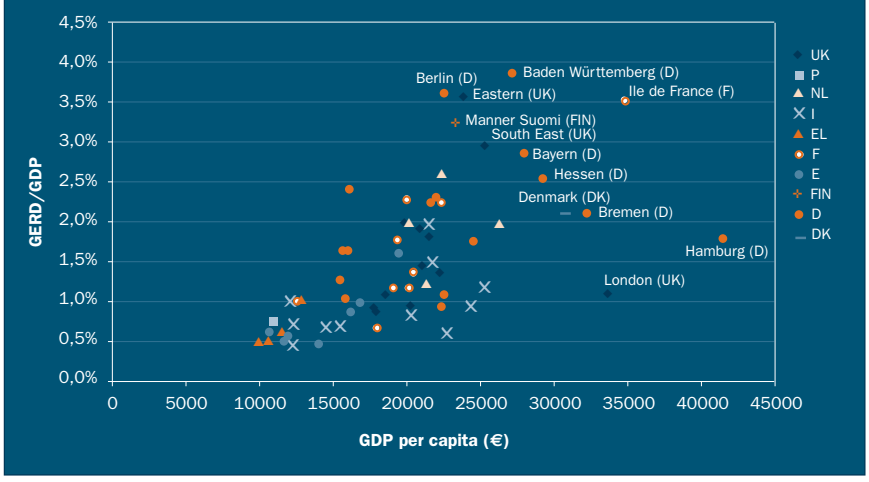
National R&D intensities vs. GDP per capita



Data: Eurostat, Source: DG Research

Figure 1.2

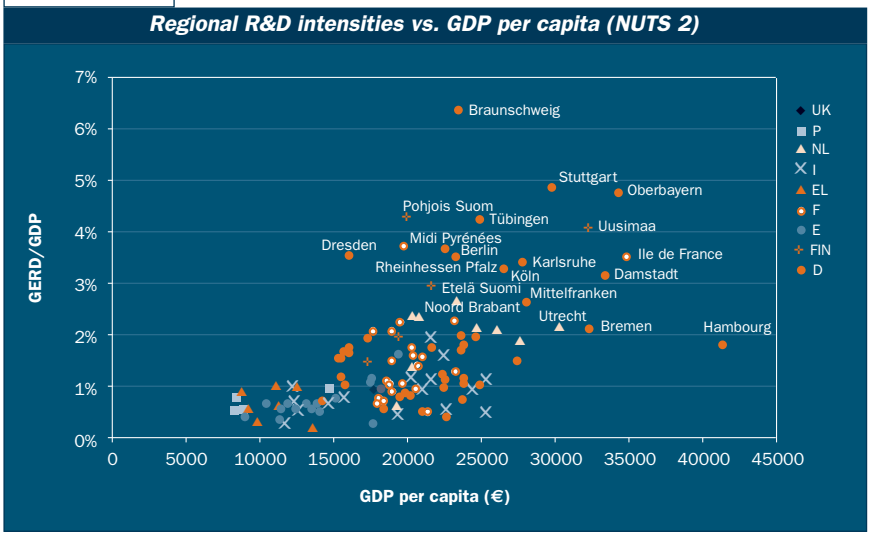
Regional R&D intensities vs. GDP per capita (NUTS I)



Data: Eurostat, Source: DG Research

(2) Nomenclature of Statistical territorial Units.

Figure 1.3



Data: Eurostat, Source: DG Research

2. National policies towards the Barcelona objective

Following the adoption of the 3% objective by the European Council in Barcelona and the subsequent Communication *More research for Europe: towards 3% of GDP*, nearly all Member States, Acceding and Candidate Countries have put in place or are planning policy measures to improve the effectiveness of their R&D and technological innovation[3] efforts. **Table 2.1** attempts to summarise the current situation in each country based on information provided over the last few months to the Commission, CREST or the Council Research working group. For a few countries the situation was not known at the time of adoption of the Action Plan. The table will be updated on the website when new information is made available.

The following general comments can be made:

– *targets:* many countries have defined national targets for 2010 or intermediary dates in terms of Gross domestic Expenditure on R&D as a percentage of Gross Domestic Product (GERD/GDP) and the share of business financing; differences in targets reflect the large disparity in starting positions; cohesion countries and Acceding Member States form a somewhat homogeneous group – with the exceptions of Slovenia and Spain – where it is not expected to rise above 2% by 2010;

– *policy developments:* national objectives converge and aim at increasing private R&D investment through a wide range of measures aimed in particular at strengthening the link between the public research base and industry, increasing skilled human resources and creating an environment conducive to more innovation; with few exceptions, countries are engaged in initiating or strengthening fiscal incentive schemes;

– *governance:* programmatic instruments and institutional responsibilities for elaborating and implementing national R&D policies vary a lot across countries; the focus on R&D policy has not reached the same intensity in all countries, nor has the level of integration with related policies.

Table 2.1: National policies towards the Barcelona objective

Country	Targets	Policy developments	Governance
Belgium	GERD/GDP[4]: 3% by 2010 This objective should apply throughout the different levels of authority (federal, regional, community)	Increasing R&D public support and supporting private R&D investment are key priorities, which require co-ordination between different levels of authority and different policies. Span of instruments/actions/policies initiated or planned: – develop human resources indigenously and improve international mobility in particular through more attractive careers, fiscal regimes and entrance conditions; – improve tax instruments, to better support the research base of large enterprises and complement direct support measures supported by regional authorities; – strengthen the link between the public research base and industry.	It is envisaged to create a "High Council on Innovation", where sectoral ministries would co-ordinate to develop the right policy mix at the different levels of authority (federal, regional, community).

(3) Technological innovation" is hereafter referred to in the text as "innovation".
(4) GERD (Gross domestic Expenditure on R&D) and GDP (Gross Domestic Product).

Country	Targets	Policy developments	Governance
Denmark	GERD/GDP: 3% by 2010 Business financed R&D/GDP: 2% by 2010	Creating knowledge is a core priority for developing a knowledge-based economy. The objective is to ensure that new knowledge and highly-qualified competencies are available for all users, including companies, institutions. The framework conditions for the development of new knowledge and centres of competence should be optimised and the transfer of knowledge to all kinds of users should be strengthened. Span of instruments/actions/policies initiated or planned: – establish a national council for technology and innovation; – reform the management and tasks of universities; – reform the national science and research advisory system; – establish a national research council underpinning research and innovation on specific strategic themes; – reform the public research sector; – improve interaction between private and public sectors on research and innovation, and in particular support their collaboration to promote the commercialisation of new knowledge. Strengthen the industry-PhD education.	The Ministry of Science, Technology and Innovation defines the national policy and is responsible for the implementation of plans and actions.
Germany	GERD/GDP: 3% by 2010 Business financed R&D/GDP: 2% by 2010	National Education, Research and Innovation policies are developed in coherence and their objectives are elements of an integrated approach. They aim to make the national research system more efficient and innovative while contributing to sustainable development and society's objectives. Span of instruments/actions/policies initiated or planned: – promote and encourage talent and achieve equal opportunities; – modernise education and research structures and safeguard quality in international competition; – promote technologies for new markets and create jobs with a safe future; – support research for man and the environment and the creation of a viable future; – strengthen centres of growth and make advances in eastern Germany through education, research and innovation.	The Federal Ministry for *Education and Research issued the programme Education*, research and innovation – Shaping the future, which sets out the main RTD&I policy objectives for the next 4 years.

Country	Targets	Policy developments	Governance
Greece	GERD/GDP: 1.5% by 2010 Business financed R&D/GDP: 0.6% by 2010	The main priority of the national research strategy is to increase the business participation in R&D activities and create critical mass in the private sector. Span of instruments/actions/policies initiated or planned: – increase the number and size of R&D intensive business firms; – promote the creation of high-tech start-ups; – support industrial R&D; – strengthen the link between the public research base and industry; – increase skilled human resources to meet economy's demand; – develop tax incentives and venture capital schemes to support R&D activities.	The General Secretary for Research and Technology within the Ministry of Development is responsible for formulating and implementing research policies. Local authorities are involved in the implementation of Regional Structural Programmes for Infrastructures and Regional Innovation. A Working Group has been established by the General secretariat for Research and Technology to examine appropriate measures and policies at European, national and regional levels towards achieving the 3% target.
Spain	GERD/GDP: 1.4%-1.5% by 2007 Business financed R&D/GDP: 0.8%-0.9% by 2007	The main policy developments in science and technology are increasing public R&D investment, providing better framework conditions for private R&D investment, increasing collaboration between the public and private sectors, strengthening the science base and ensuring skilled human resources. Span of instruments/actions/policies initiated or planned: – encourage PPP in national and EC programmes; – use of Structural Funds for R&D activities; – involve industry in the formulation of R&D priorities; – increase the number and quality of R&D human resources; – increase the innovation and technological capacity of enterprises and promote the creation of innovative enterprises; – strengthen the link between the public research base and industry, in particular through technology transfer from the public sector; – boost co-operation and co-ordination between public R&D institutions.	The National Plan of Research, Development and Technological Innovation (2004-2007) is being prepared in co-ordination with regional RTD&I plans.

Country	Targets	Policy developments	Governance
France	GERD/GDP: 3% by 2010 Business financed R&D/GDP: 2% by 2010	Promoting innovation is a key priority of national economic policy. The objective is to create an environment conducive to entrepreneurship and private investment in R&D. While continuing to aim at excellence, innovation policy will also increasingly build on the legal-institutional-fiscal framework, the management of human resources, and evaluation and monitoring. It aims at a greater opening of public research to industrial needs and society at large. Span of instruments/actions/policies initiated or planned: – facilitate the creation and growth of young innovative enterprises; – create a fiscal and legal environment for young innovative enterprises; – promote business angels, seed capital, capital risk and tax schemes in particular for young innovative enterprises; – strengthen PPP, including through joint patenting and exploitation; – promote public research evaluation; – focus resources on key areas, in particular on biotechnology; – reinforce the role (financing) of foundations; – render science more attractive to the youth and attract foreign scientists.	The Industry and Research Ministries are jointly defining the innovation policy and developing a new implementation plan. Local authorities will be involved to leverage innovation.
Ireland	GERD/GDP: 2.8% by 2006 Business financed R&D/GDP: 2% by 2006 National and regional targets for 2010 are in preparation	The National Development Plan (2000-2006) provides for increased public investment in science, technology and innovation. It aims at reinforcing the basic R&D capability in public institutions, supporting applied research activities in industry, and strengthening collaboration between public institutions and industry. Emphasis is set on developing framework conditions that better link research with commercial reality. Span of instruments/actions/policies initiated or planned: – increase public support to industrial R&D; – network enterprises with the wider S&T infrastructure; – support the development of strategic technologies, in particular in the areas of ICT and biotechnology, through the *Science Foundation Ireland;* – investigate possible R&D tax credit schemes.	The Department of Enterprise, Trade and Employment has overall co-ordinating responsibility for RTD&I measures in the National Development Plan. Its "High Level Cross Departmental Group" is responsible for defining actions contributing to ERA's objectives.

Country	Targets	Policy developments	Governance
Italy	GERD/GDP: 1.75% by 2006 Business financed R&D/GDP: 0.75% by 2006	Increasing public funding in order to attract major private investments in R&D is a key priority. Span of instruments/actions/policies initiated or planned: – support basic research activities of the Italian scientific system aimed at advancing the frontiers of knowledge; – support basic research activities aimed at developing key multisectoral enabling technologies; – strengthen industrial research activities and public/private collaboration; – support collaborative projects at local level.	The "Comitato Interministeriale per la programmazione economica" adopted in June 2002 the National Guidelines for science and technology policy.
Netherlands	GERD/GDP: among leading EU countries by 2010 Business financed R&D/GDP: higher than EU-average by 2005	The national priorities for improving the efficiency and effectiveness of the national knowledge production system are to maintain a strong public research base, increase the output of public R&D, raise the level of private R&D, invest in excellence in key technologies and develop the supply of skilled human capital. Span of instruments/actions/policies initiated or planned: – increase skilled human resources, in particular through gender balance, stimulate mobility between public research organisations and enterprises, improve immigration procedures for foreign scientists and stimulate lifelong learning; – improve the efficiency and effectiveness of public research and innovation instruments; – strengthen long-term co-operation between the public research base and industry; – evaluate the role of intermediary knowledge institutions for the interaction between basic/strategic research and the application of knowledge within enterprises; – promote PPP to strengthen the knowledge infrastructure in strategic fields.	The Ministry of Economic Affairs has a co-ordinating responsibility for Innovation and ICT. It will publish new White Papers on Innovation and on ICT. The Ministry of Education, Culture and Sciences is responsible for Science policy and is preparing the Science Budget for the forthcoming years. A commission was established to improve the horizontal co-ordination of Science, Innovation and ICT policies and assist the Government in its decision-making.

Country	Targets	Policy developments	Governance
Austria	GERD/GDP: 2.5% by 2006 and 3% by 2010	The key objectives are, developing an effective policy mix of public support measures and bottom-up funding mechanisms and orienting public support towards more technologically demanding, riskier and more innovative projects. Span of instruments/actions/policies initiated or planned: – promote the dialogue between science and society, in order to discuss future activities for achieving the Barcelona objectives; – promote basic research as a core element of the public research base, both through suitable bottom-up mechanisms and centres of excellence; – strengthen the link between the public research base and industry; – raise the number of graduates, promote women researchers in the public and the private sectors, facilitate access for foreign researchers and promote lifelong learning; – promote the mobility of students and researchers, and take specific measures to facilitate their return; – improve framework conditions to further develop risk capital; – further open up national and regional research activities to enable targeted networking with centres of excellence in other countries and regions.	Two inter-ministerial working groups were established to identify and coordinate the implementation of cross-policy measures involving education and the economy at large. In preparation of future activities a status report ("Austrian Barcelona Report 2003") was drafted under the responsibility of the Federal Ministry for Education, Science and Culture.
Portugal	GERD/GDP: 1% by 2003	The core priorities of the RTD&I policy for the near future are supporting the performance of business R&D, reinforcing the interaction between the public research base and industry and further developing the training of highly qualified human resources. It aims in particular at a considerable increase of business involvement in research and innovation activities. Span of instruments/actions/policies initiated or planned: – promote technology transfer from public research institutions to industry and support the commercial take up of R&D results; – support the development by industry of new products, processes and services, in particular through increased participation in European and international research cooperation; – create and support new high tech firms, including spin-offs from public research institutions, in particular through venture capital, fiscal incentives and adapted IPR regimes; – encourage PhD students to choose themes in line with the interest of companies and support the insertion of PhD in the business sector.	The Ministry of Science and Higher Education and the Ministry of Economy are closely cooperating in the definition and implementation of these actions.

Country	Targets	Policy developments	Governance
Finland	GERD/GDP: higher than 3.5% from 2002 onwards Government financing of R&D should grow faster than GDP	The national strategy is to strengthen support to technological & social innovations and knowledge-based international business ventures, through intensifying both international co-operation and collaboration between public and private sectors. Direct support measures are preferred to fiscal incentives. Span of instruments/actions/policies initiated or planned: – focus national competencies on new promising fields whilst further reinforcing existing strengths; – strengthen the link between the public research base and industry and provide incentives for universities to better respond to needs in terms of education, researchers' training and commercial exploitation of results; – increase public financing to augment human resources and knowledge base, support technological & social innovations and improve the flexibility of the innovation system.	The Science and Technology Policy Council issued in January 2003 its 6th triennial review on *Knowledge, innovation and internationalisation*.
Sweden	Maintain current high level of GERD/GDP	The national emphasis lies on developing framework conditions conducive to private R&D investment, increasing public funding of R&D institutions and promoting PPP based on universities and institutes, building on different sources of R&D financing (national, FP, COST, Eureka). The policy strands concerned are fundamental research, business development and economic growth. Span of instruments/actions/policies initiated or planned: – improve recruitment of young researchers and increase mobility of skilled human resources, including from abroad; – build PPP in research projects based on universities and institutes; – establish a competitive and knowledge-based environment for knowledge production and business development; – increase public support to fundamental research, such as biotechnology and medicine, ICT, material sciences, environmental science and to research on humanities, social sciences, health and social services.	Forthcoming bill for public financing of R&D.

Country	Targets	Policy developments	Governance
United Kingdom		The UK Government's policy aims are broadly: – to make framework conditions conducive to business investment in R&D for innovation; – to improve knowledge transfer, including business-university interactions, so that research is translated into innovation and other wider benefits; and – to continue to support the UK's excellent science base (overall science spending will be around £1 1/4 billion higher in 2005-06 than it was in 2002-03). This is set out in detail in *Investing in Innovation – A strategy for science, engineering and technology*. The UK is also conducting reviews of business innovation and business-university interactions to provide a strategy for improving the UK's innovation performance and to enable business-university interaction to provide a greater contribution to UK growth. Policies to improve framework conditions include: higher levels of competition; increasing supply of appropriate skills; direct support for innovation; and R&D tax credits for large companies and SMEs.	The UK sets policy aims within Public Service Agreements (PSAs). The Department for Trade and Industry (DTI) is responsible for the PSA on science and innovation, which has the aims of improving: (i) the relative international performance of the UK's science and engineering base; (ii) exploitation of the science base; and (iii) the overall innovation performance of the UK. DTI is developing indicators to monitor progress and guide future policy and resource allocation decisions.
Bulgaria		An Innovation Strategy and a Bill on Support of Scientific Activities are under development. This new environment for the national scientific policy will cover human resources, decentralisation of funding and support to strategic, applied and fundamental research. Span of instruments/actions/policies initiated or planned: – adopt a package of direct and indirect financial and tax measures; – support innovative actions and research activities of SMEs; – strengthen the link between the public research base and industry; – establish investment funds to stimulate RTD&I, including a pilot scheme for supporting risky projects.	A mechanism for co-ordinating all efforts in the field of Science and Research has been created. The Ministry of Education and Science has launched National Scientific Programs for Research and Innovation that are reciprocally open for research entities from abroad.

Country	Targets	Policy developments	Governance
Cyprus	GERD/GDP: 0.5% by 2006	Enhancing research activities of both the public and the private sectors, on the basis of the guiding principles set by the European Council in Barcelona, is a national priority. It aims at improving the general support framework for research activities and enhancing the potential of research entities. Span of instruments/actions/policies initiated or planned: – upgrade research infrastructures; – strengthen the link between the public research base and industry; – develop international research cooperation, using in particular FP6; – upgrade human resources engaged in research; – increase citizens' awareness of the importance and benefits of research for the economy and society at large.	A Strategic Plan for Science and Research has been developed for the period 2004-2006.
Czech Republic	GERD/GDP: 2% by 2010 Business financed R&D/GDP: 1% by 2010	The development of an Innovation Policy is under consideration, in complement to the National R&D Policy. Span of instruments/actions/policies initiated or planned: – improve the relation between science and society; – implement foresight into decision-making strategy; – strengthen the link between the public research base and industry; – promote researchers' mobility and support the return of national scientists; – support technology transfer to business and encourage spin offs; – take advantage of Structural Funds to support R&D activities.	Preparation of the National Research Programme and updating of the National R&D Policy.
Estonia	GERD/GDP: 2002: 0.8% 2003: 0.9% 2004: 1.1% 2006: 1.5% Business financed R&D/GDP: 0.6% by 2006	The priorities are increasing the economy's absorptive capacity of new knowledge and technologies and encouraging industry to invest more in R&D and product development. Span of instruments/actions/policies initiated or planned: – develop an environment favourable for entrepreneurial activities in universities and R&D institutions; – create more active co-operation between the research community and industry through the Competence Centres programme.	Adoption in December 2001 of the Estonian Research and Development Strategy 2002-2006 "Knowledge-based Estonia".

Country	Targets	Policy developments	Governance
Hungary	GERD/GDP: 1.8%-1.9% by 2006 Business financed R&D/GDP: 0.9%-1% by 2006	RTD&I is a priority of the Economic Competitiveness Operative Programme embedded in the strategic mid-term National Development Plan (2004-2006). It aims at supporting public research institutions, developing the innovation capabilities of the private sector and strengthening the link between the public research base and industry. Span of instruments/actions/policies initiated or planned: – improve public acceptance of R&D and innovation and the link between science and society; – support the establishment of networks to promote technology transfer, co-operation between public and private R&D institutions and commercial exploitation of R&D results; – support high tech knowledge centres, clusters and incubators; – promote R&D private financing through tax incentives; – develop highly skilled human resources and increase researchers' mobility between academia and industry; – take advantage of Structural Funds to implement regional innovation programmes and to support cross-border regional innovation partnerships and existing business networks.	The Law on Research and Development under preparation will establish the Science and Technology Policy Council. This top-level S&T policy making and coordination forum will be presided by the Prime Minister, and will include the Minister of Education and the President of the Hungarian Academy of Sciences. The National Research and Technology Office is to be established by the end of 2003 and will be in charge of S&T policy making, EU integration in the R&D field, international relations, as well as the operation of the National R&D and Research-Utilisation Fund.
Latvia	GERD/GDP: 2% by 2010 Business financed R&D/GDP: 1% by 2010	The main objective of the National Innovation Programme (2003-2006) is to create an environment conducive to innovation and to a competitive business sector. It aims in particular at strengthening the link between the public research base, industry and societal needs. A specific programme also targets the Renewal of Scientific and Academic Staff and special support is granted to research centres labelled as Centres of Excellence.	The National Innovation Concept was adopted in 2001 at Government level and is at the origin of the National Innovation Programme (2003-2006). The Ministry of Education and Science and the Ministry of Economics develop respectively research policy and innovation policy.
Lithuania	GERD/GDP: 1.5% by 2006 Business financed R&D/GDP: 0.8% by 2006	A programme will shortly be adopted by the Government to implement its long-term development strategy for research and innovation (2003-2006). It aims at enhancing the international competitiveness of national R&D and encouraging private investment in R&D. Span of instruments/actions/policies initiated or planned: – create favourable and attractive conditions for business investments into R&D; – enhance international competitiveness of Lithuanian R&D; – increase S&T human resources; – determine national priorities of R&D, improve evaluation indicators and the system of R&D indicators.	National RTD&I policy is elaborated and implemented in collaboration between several Ministries: Education and Science; Economy; Agriculture; Finance and Justice. The Department of Statistics and the Information Society Development Committee of the Government are also associated.

Country	Targets	Policy developments	Governance
Malta		The forthcoming National RTD&I Strategy 2003-2006 is due to include a set of measures for meeting Barcelona's targets in particular through the setting up of a National RTD&I Programme.	The Malta Council for Science and Technology is in charge of the development of the National RTD&I Strategy and its implementation framework.
Poland	GERD/GDP: 1.5% by 2006 Business financed R&D/GDP: 0.9% by 2006	Promoting R&D is one objective of the National Development Plan (2004-2006). The main objectives are to increase the efficiency and leverage of R&D public financing, improving industrial competitiveness and contributing to the economic strategy at large. Span of instruments/actions/policies initiated or planned: – strengthen the link between the public research base and industry; – stimulate R&D demand and enhance the take-up of R&D results; – develop a framework supporting innovative activities by enterprises.	Creation and empowerment of the Ministry of Science and IT. The National Innovation and Science Policy is framed in the Government's document *Modern Poland – Information Technologies, Knowledge, Competitiveness*.
Romania	Government financed R&D/GDP: 2002: 0.2% 2003: 0.2% 2004 0.32% 2005: 0.47% 2007: 1%	The stimulation of private R&D investment relies on the co-ordination of the research, industrial and financial public policies. The main objectives are to increase government financing for RTD&I activities and their impact on industrial competitiveness, develop measures conducive to higher industry expenditure on R&D, and stimulate the development of S&T human resources. Span of instruments/actions/policies initiated or planned: – promote PPP and industry co-financing; – promote a wide range of financial and fiscal incentives; – support the development of centres of excellence; – stimulate technology transfer, the take-up of R&D results and spin-offs from institutes and universities; – support the creation and development of innovative SMEs in the high-tech sector through the creation of the *Investment Society for Technological Transfer and Development* and risk capital instruments; – promote S&T careers and researchers' international mobility.	The National Plan for RTD&I and the Programme for technology transfer are co-ordinated by the ministry for Education and Research, and are complemented with R&D actions conducted by the Ministry of Development and Prognosis and the Ministry of European Integration. In 2002 the Ministry of Education and Research concluded special agreements with the Ministry for SMEs and Cooperation and with the State Office for Patents and Trademarks, in order to co-ordinate actions directed towards the stimulation of innovative activities in enterprises.

Country	Targets	Policy developments	Governance
Slovenia	GERD/GDP: 2003: 1.5% 2004: 1.6% 2005: 1.8% 2006: 2.1% 2007: 2.4% 2008: 2.7% 2009: 2.9% 2010: 3% Business financed R&D/GDP: 2% by 2010	The action plan for reaching the 3% target builds in particular on the National R&D Program and the National Strategy of Economic Development. It calls for the creation of an environment stimulating entrepreneurship and innovation, the maintenance of a strong science base and the strengthening of the link between the public research base and industry. Span of instruments/actions/policies initiated or planned: – support industrial R&D; – develop fiscal measures and tax incentives; – develop skilled human resources; – support the transfer of knowledge from public research institutions; – support the development of S&T parks and infrastructures for technology transfer, and stimulate spin-offs from institutes and universities; – create technology networks and clusters.	The Council for Science and Technology assists the Government in defining the National R&D Programme with the support of economic stakeholders.

3. Response of the business sector to the first Communication

Approaching an R&D investment level of 3% of GDP by 2010, with two-thirds coming from the business sector, implies that private expenditure on R&D will have to increase considerably more than public expenditure, and also that the public sector has important role to play in order to encourage private investment.

The first Commission Communication was aimed at opening a debate and consulting the stakeholders concerned, in particular the business actors, on the issues to be tackled and the policy areas concerned. The Commission undertook a wide consultation of Member States and Acceding Countries, as well as European associations in the industrial, public research and financial sectors. EURAB[5] (European Research Advisory Board) also adopted a position report. Responses were overwhelmingly supportive of the 3% objective and included many valuable comments and recommendations that have been taken into account in preparing the action plan. Responses to the first Communication are available on the "3% web site"[6].

This section focuses on the response of the business sector from which a large part of the increased investment in research is expected to come. The Communication was sent to 43 various industrial organisations and 20 financial organisations throughout the EU to seek their views on the approach proposed and actions to be undertaken in the various policy areas identified. Replies have been received from 14 industrial organisations and 4 financial organisations.

3.1 A VERY SUPPORTIVE REACTION AND A CALL FOR RADICAL ACTIONS

Overall, the business response strongly supports the need to increase research efforts to strengthen EU competitiveness, economic growth and employment, and the policy approach proposed by the Commission. The key challenge is to make Europe more attractive for business R&D investment and innovation. The main messages can be summarised as follows:

- the 3% objective will only be achieved if Europe radically improves European centres of excellence, skills and education, builds a more supportive regulatory environment for R&D and innovation, and a strong and vibrant public research sector with improved links with industry; current policies and practices in Europe make it unlikely that this target will be achieved without such a radical reconsideration;
- a more coherent policy approach is needed, requiring on the one hand, co-ordination of the R&D policies of the Member States as well as the EU, and on the other hand, coherence between R&D policy and other policies such as competition, regional, environment, industry and education policies, which have major implications for R&D investment and have to be assessed;
- industrial research is increasingly taking on a European and even global dimension; fragmentation of effort, isolated national research systems and disparities between legal and administrative regimes are taking their toll on R&D investment; to give a new impetus to research in Europe and achieve the critical mass needed in cutting-edge sectors, it is vital to open up, integrate and concentrate the research effort; the 3% objective and the European Research Area are both pivotal to restore confidence in the knowledge-based economy and to move out of the current crisis with a renewed growth based on more and better R&D efforts.

3.2 BREAKDOWN OF THE BUSINESS RESPONSE

Table 3.1 presents a breakdown of the business response according to the main areas for action identified in the first Communication, e.g. human resources, entrepreneurship, etc. The breakdown is based on the frequency with which these main areas are mentioned in the contributions received. They are available *in extenso* on the 3% web site: http://europa.eu.int/comm/research/era/3pct.

(5) "Boosting Joint Investment in Research: Towards 3% of GDP" , December 2002, http://europa.eu.int/comm/research/eurab/pdf/eurab-02-066-final-joint-investment-recommendations.pdf
(6) http://europa.eu.int/comm/research/era/3pct

Table 3.1

Response of the business sector to the 1st Communication

Breakdown* of contributions from industrial and financial organisations * as interpreted by the Commission on the basis of contributions received and available in extenso on the 3% web site: http://europa.eu.int/comm/research/era/3pct	Industry													Finance				
	ERT[1]	UNICE[2]	EICTA[3]	EIRMA[4]	CEFIC[5]	Confindustria[6]	UIC[7]	FIEC[8]	ECCREDI[9]	AIRTO[10]	EARTO[11]	Eucomed[12]	FAIP[13]	EUTELSAT	FEFSI[14]	BEI/FEIG	BERD[16]	EAPB[17]
Human resources	•	•	•		•		•	•	•		•	•				•	•		
Public research base and its link with industry	•	•	•	•	•	•	•		•	•	•	•	•			•			
Entrepreneurship		•	•	•	•				•			•	•		•	•		•	
IPR	•	•	•	•	•				•				•			•		•	
Regulations	•	•	•		•	•	•	•	•			•				•	•	•	
Competition rules		•	•			•		•	•					•		•		•	
Financial markets		•	•						•						•				
Macro-economic stability and fiscal conditions			•						•										
Corporate strategies			•																
Direct support measures	•		•						•				•						
Fiscal incentives	•		•					•	•					•					
Risk capital and guarantee mechanisms	•		•		•							•				•		•	
Mix of financing instruments		•	•						•							•	•	•	
Coherence between policies having an impact on investment in R&D		•	•	•								•							
Co-ordination of national policies	•	•	•	•	•	•	•			•								•	
Joint efforts of stakeholders (e.g. Technology Platforms)			•		•		•				•								

1 European Round Table of Industrialists; 2 Union of Industrial and Employers' Confederations of Europe, 3 European Information, Communication and Consumer Electronics Technology Industry Association; 4 European Industrial Research Management Association, 5 European Chemical Industry Council, 6 Confederazione Generale dell'Industria Italiana; 7 Union Internationale des Chemins de fer; 8 European Construction Industry Federation; 9 European Council for Construction Research and development and innovation; 10 Applied Industrial research Trading Organisations; 11 European Association of research and Technology Organisations; 12 European Medical Technology Industry Association; 13 Farm Animal Industrial Platform; 14 Fédération européenne des fonds et sociétés d'investissements; 15 Banque européenne d'investissement, Fonds européen d'investissement; 16 European Bank for Reconstruction and Development; 17 European Association of Public Banks.

The table shows that actions are considered necessary in all areas. This is consistent with the need expressed by industry to mobilise in a coherent way a wide range of policies to put in place incentives and framework conditions encouraging business investment in R&D. The need for a broad policy mix is particularly reflected in the replies from business associations with a wide spectrum of industrial sectors or sectors with high R&D intensity.

This being said, a number of areas have been more frequently mentioned than others:

– very frequently mentioned: *Public research base and its link with industry; R&D friendly regulations; Human resources*;
– frequently mentioned: *Entrepreneurship; IPR; Competition rules; Financial markets; Direct support measures; Risk capital and guarantee mechanisms; Fiscal incentives; Overall mix of financial instruments; Co-ordination of national policies; Coherence between policies having an impact on investment in R&D; Joint efforts of stakeholders;*
– less frequently mentioned: *Macro-economic stability and fiscal conditions; Corporate strategies.*

The most frequently mentioned areas correspond to issues which can be addressed through focussed policy measures and expected to have a direct effect on industrial investment in R&D. Although also considered relevant, the less frequently mentioned areas relate to the general economic environment and to firms' internal strategies.

3.3 MAIN RECOMMENDATIONS

Three business associations have provided comprehensive recommendations on the Communication: ERT[7] and UNICE[8] representing a broad spectrum of industrial sectors, and EICTA[9] representing a very R&D intensive sector which carries out a large fraction of industrial R&D. Their own summaries of recommendations are presented, given that they reflect well the overall business input:

3.3.1 ERT

Attaining the 3% goal of GDP target spending requires dramatic, predictable, long term commitment from both the European Union and Member States across a range of policies, including R&D, education, internal market, competition and enterprise policy. ERT urges EU governments to address as a matter of priority the following issues to boost research and innovation:

- ***Invest in centres of excellence, raise the status and supply of scientists***

– *Develop strong R&D centres of excellence* in key industrial fields such as ICT, advanced new materials and healthcare. In addition to higher public funding, a more focused common EU strategy requires a reallocation of resources towards industrial sectors that have the highest impact on productivity and economic growth.
– *Improve the supply of skilled labour for R&D* by reforming educational priorities and policies. Immigration restrictions should also be removed for people with relevant skills.
– *Strengthen the positive perception of technology* by tackling the cultural bias against it. Improve rewards and recognition of its economic and social importance in all relevant sectors, including engineering.
– Improve the salaries and career prospects of top research staff and the equipping of university laboratories.
– Encourage and reward public/private partnerships and collaboration between public research institutions and improve mobility of researchers between public and private R&D.

- ***Increase public spending to encourage more private R&D spending***

– Encourage *higher government financing of business R&D and a range of tax incentives* to stimulate more private investment in R&D. A predictable and stable system should apply equally to large and small companies irrespective of whether they are profitable.
– *Stimulate the creation of cross-border collaborative R&D networks* with large and small companies and academic participation. The emergence and development of networks will be strongly helped if public funding is available in the pre-competitive research stage.
– *Create better markets for venture capital* through appropriate incentives and harmonise the market conditions in the EU.

- ***Legislate for improved protection of Intellectual Property and cut the red tape holding back new products and technologies***

– *Improve protection of Intellectual Property* in Europe to encourage R&D in new areas including genetically modified organisms (GMOs) and software.
– Urgently *agree a quality, cost-efficient Community patent* so as to strengthen protection and reduce bureaucracy, costs and litigation. Costs will only be kept down if the language requirement is kept simple (preferably filing in English only).
– *Radically reduce unjustified regulatory constraints* (environmental, administrative, etc.) which hold back the development, production and introduction to market of new products and technologies.

3.3.2 UNICE

For increasing R&D investment to 3% of GDP, we must ensure:

– A supportive environment for industrial R&D: not only must inappropriate barriers to R&D based innovation be removed, but also a forward-looking,

(7) European Round Table of Industrialists: a forum of around 45 European industrial leaders aiming at promoting the competitiveness and growth of Europe's economy.
(8) Union of Industrial and Employer's Confederations of Europe, representing 16 millions firms through 35 national federations.
(9) European Information, Communication and Consumer Electronics Technology Industry Association, combining 29 national ICT/CE associations with 43 direct company members, altogether representing more than 10,000 enterprises in Europe.

stable, regulatory environment must be established. A financial environment must also be developed which supports industrial R&D investment both through direct and indirect measures, which will permit EU firms to compete at a global level.

– A coherent approach across the EU: A concerted research policy should be developed across the EU through the submission of Member States' annual research budgets to the Competitiveness Council "for comments". There is also a need for coherence between research policy and other related policies, at a Commission and Member State level.

Main UNICE recommendations:

- A legislative and regulatory environment attractive for private R&D investment
  - The creation of a transparent, coherent and stable regulatory environment to encourage industrial research investment.
  - The reduction of barriers to market development: inappropriate standards, regulations and legislative requirements, which slow or prevent access of newly developed products and services to markets across the EU.

- Financial instruments for the promotion of private R&D investment
  - The Commission should engage Member States in an analysis of direct and indirect financial instruments for the promotion of R&D. Appropriate and effective measures to enhance investment should then be implemented with Commission support.
  - National financial instruments for R&D should be extended to R&D undertaken by institutes in any EU Member State.

- The co-ordination of research policies across the EU
  - Member States, on an annual basis, should circulate their research programme priorities and budget distribution to the Competitiveness Council "for comment".
  - While calling for co-ordination of public research at regional, national and European levels, UNICE wants to recall the limitations imposed by the subsidiarity principle; e.g. academic research in universities often backs high scientific education which is under the responsibility of the Member States.
  - Bottom-up co-ordination initiatives both from the public and the private sector should be preferred to top-down prescriptions and encouraged by the Commission in order to find the right balance between avoiding unnecessary duplications and fostering useful emulation between research groups working on similar topics.

- Coherence between research and related policies
  - Reorient existing EC, Member State and regional budget expenditures towards areas, such as education and research, which will provide for innovation and future economic and employment growth, and away from traditional consumption, *status quo* spending patterns.
  - As policies are generated in other areas (e.g. transport, health, energy, environment), an assessment of their implications for R&D policy, as well as for economy and entrepreneurship, should be made. The R&D implications of specific laws, regulations and directives - positive and negative- should be clearly signalled to the research community in industry and academia. The Commission should initiate the development of such mechanisms in Member States as well as in the Commission itself.

- Supportive actions for public research and human resources

  The Commission should initiate with Member States:
  - Strengthening the education role of universities to overcome the potential bottlenecks in various research disciplines.
  - Strengthening the education role of schools and universities to overcome the potential bottlenecks in various innovation-related disciplines in particular natural sciences and engineering.
  - Increasing levels and efficiency of university-

industry co-operation – including public-private partnerships.
– Create means to reverse the brain drain and increase human resources.

UNICE and DG Research organised in November 2002 a series of workshops[10] in order to identify good practices and to ascertain industry's views on the following themes: Public R&D and its links to industry; Regulatory Environment favourable to R&D and innovation; Human resources; IPR and technology transfer; Financial markets, Macro-economic and fiscal environment; and R&D in innovation and corporate strategies. The outcome was an extensive catalogue of recommendations. The following presents a short selection of recommendations, which are seen by UNICE as the most relevant results of the workshops:

– in order to get more innovation out of public research, establish *free and effective flow of existing research results* from academia to industry;
– analyse and possibly apply, *for opening up national research programmes*, the possibility to include a foreign partner if there is a national interest for a specific research project;
– give state-funded universities full flexibility and freedom to act within their existing budget limits;
– the Commission and Member States should ensure that in Europe *"mission- oriented public research"* is funded as intensely as in competing economies, that the respective targets and activities are consequently harmonised across Europe and that they benefit large enterprises and SMEs alike;
– the *regulations for R&D State aid should be improved and simplified* by abolishing the distinction between industrial research and precompetitive development; the Commission should also not *a priori* disqualify state aid for R&D projects that fall within a firm "core business" or which have a clear market potential;
– the Commission should ensure that European companies do not suffer from competitive disadvantages vis-à-vis their competitors located outside the EU, who are not (or less) affected by R&D subsidies control. In particular, the Commission should *reconsider the appropriateness of current ceilings for subsidies to R&D* in Europe when the Union's main competitors have none; this would strengthen the Union's negotiating position when seeking to establish a new global agreement for R&D subsidies through the WTO;
– initiate a benchmark of successful initiatives to promote science;
– introduce a *scientific visa* to promote mobility of researchers across Europe;
– create a *single Patent Jurisdiction Court and Court of Appeal*, which are considered essential for Europe;
– adapt IPR and Competition law frameworks to encourage industry/university strategic alliances;
– the possibility of an *expanded role for the EIB/EIF* should be explored, for example in providing mezzanine debt specifically for later round financing to support high-tech companies in VC portfolios; in the US there are specialised banks that do this, e.g. Silicon Valley Bank, but they tend to have drastic requirements for security, e.g. intellectual property rights;
– a *consolidated tax base* for European companies might be useful and should be seriously considered;
– introduce an *"innovation test"* for new regulations.

3.3.3 EICTA

The Barcelona 3% objective focuses only on raising R&D expenditure. However relevant in itself, EICTA considers R&D as only one of the inputs of Europe's innovation system. What ultimately matters most for competitiveness is raising output in terms of new products and services successfully launched on the marketplace. To trigger more innovation, also market pull from strong customer demand and economic growth is essential.

(10) In addition to the majority of participants from industry, there were also participants from public research organisations and the financial community depending on the theme.

In Europe's innovation system, governments should play a major role, not only on the supply side (by stimulating R&D and creating favourable framework conditions), but also on the demand side (by helping to create markets and aggregating demand). In this respect, EICTA suggests more active use of public procurement, governments acting as launching customers, and adequate legislation to back up the results of European R&D. The eEurope 2005 Action Plan should be fully implemented.

No simple, fix-all solution exists for filling the gap between the EU and the US. Nevertheless, EICTA would particularly like to highlight the following of its many recommendations:

- *raise interest for ICT and S&T among youngsters* and facilitate immigration of non-EU talent;
- *strengthen links between public and private research* by rewarding academic researchers not only for scientific output, but also for co-operation with industry;
- give researchers in academia and industry training in *entrepreneurial skills*;
- *truly complete the internal market* to increase returns on R&D investments;
- provide adequate support for private R&D through predictable and stable *incentive schemes for small and large firms alike*;
- *modernise EU rules on State aid for R&D* to make public support more effective and create a level playing field, also at the worldwide level;
- *adapt governance models to the knowledge-based economy, e.g.* by each Member State appointing a single minister for science, technology and innovation.

4. Contributions of the 6th FP to the Barcelona objective

The 6th Framework Programme and its specific programmes have been designed to support the establishment of a European Research Area, an endeavour which was endorsed by the European Council in Lisbon as a central element of the Lisbon strategy to make Europe the most dynamic and competitive knowledge economy in the world by 2010. It comprises a variety of new or improved instruments and actions which will help achieve the Barcelona objective.

An overview of the relevant instruments and actions and their expected contributions is provided in **Table 4.1.** This overview focuses on the instruments and actions which are expected to improve the effectiveness of European Research and innovation efforts and policies, to increase the leverage effect of public support on private investment, to make Europe a more attractive place for researchers and firms and to foster better integration of research and innovation in other policies.

Several FP6 actions are building on and strengthening activities carried out or initiated under the 5th FP in particular in the areas of human resources, indicators, foresight, research policy (STRATA-ETAN), and benchmarking.

Table 4.1: Overview of contributions of the 6th Framework Programme to the Barcelona objective[11]

Instruments/actions of the 6th Framework Programme	**Expected impacts**
New instruments to support European R&D collaboration and integration of capacities: Networks of Excellence and Integrated Projects which can include training, education, and innovation activities. (www.cordis.lu/fp6/instruments.htm) Research programmes undertaken jointly by several Member States with Community support (art. 169). (http://www.cordis.lu/fp6/instr_169.htm)	– more strategic industrial and public-private partnerships with enhanced diffusion and use of results; – integration and building of research capacities; – increased number of world-class European- centres and networks of excellence.
Within and across thematic priorities (beyond R&D funding): actions to foster and support the establishment of European Technology platforms: bringing together various stakeholders concerned (industry, public research organisations, users, public authorities, financial community, etc.) to define a common strategic agenda for the development and deployment of key industrial technologies, including regulatory aspects.	Increased competitiveness of key industrial sectors while maximising societal benefits through: – wider and more effective mobilisation of strategic public and private research efforts; – more coherent and timely policy actions to improve regulatory environment.
Thematic priority "citizens and governance in a knowledge-based society: support of European research to develop knowledge necessary to understand and address issues related to the emergence of the knowledge society[12]. (www.cordis.lu/fp6/citizens.htm)	Improved scientific base for the definition and implementation various policies to foster the transition to the knowledge economy.
Research for policy support: activities to underpin the formulation and implementation of Community policies. (www.cordis.lu/fp6/citizens.htm; www.jrc.it)	Improved scientific base for the definition, implementation and monitoring of sectorial and horizontal policies.

(11) The table focuses on the indirect *actions of the Framework Programme and their impacts, which are relevant to the Barcelona objectives. Several* direct *actions of the JRC are also relevant, in particular the S&T foresight activities and the various activities in support of the design and implementation of other Community policies (www.jrc.it).*

(12) Results from activities initiated under the 5th Framework Programme will be available starting in 2003.

Instruments/actions of the 6th Framework Programme	Expected impacts
SME activities: - target of 15% of the budget for SMEs in thematic priorities; - collective and co-operative research projects; - economic and technology intelligence activities; - information and awareness actions. (www.cordis.lu/fp6/sme.htm)	– increased trans-national collaboration and technology transfer between SMEs, large firms and public research organisations; – increased innovation in SMEs with little research capacity, through R&D outsourcing and a more active role of industrial associations.
International co-operation activities. (www.cordis.lu/fp6/inco.htm)	Improved access to and benefit from knowledge and expertise existing in third countries.
Human resources and mobility: a coherent set of actions to support the development of abundant and dynamic world-class Human Resources in Europe. (intranet-rtd/politique/progr-specif2_fr.shtml; europa.eu.int/comm/research/fp6/mariecurie-actions/home_en.html)	– increased opportunities for high quality training of researchers; – increased number of more adequately trained researchers; – increased career opportunities for researchers in Europe, both in academia and industry; – increased partnership and knowledge transfer between European and non European research organisations and between industry and academia; – more women and junior researchers pursuing a research career; – increased in-flow of researchers from third countries and return of European researchers to Europe; – enhanced research potential of less developed regions and associated candidate countries.
Research and innovation: - trans-national networking of research and innovation players; - support to mutual learning in the development of regional innovation policies; - provision of innovation support services at European level. (www.cordis.lu/fp6/innovation.htm)	Enhanced economic and social benefits from European research efforts through: – increased technology transfer and use and entrepreneurial innovation; – more effective provision of and access to innovation support services at regional, national and European levels (IPR, technology transfer, access to finance); – improved or wider adoption of innovation strategies at regional level; – increased absorptive capacity of innovations of SMEs in less developed regions and Candidate Countries.
Research infrastructures: various actions to support a more effective and integrated provision of world-class European research infrastructures and their optimal use. (www.cordis.lu/fp6/infrastructures.htm; www.jrc.it)	– enhanced European capacity to conduct forefront research in key S&T fields, to network research organisations, and to attract top-level researchers; – improved integration of research facilities of less developed regions and Candidate Countries into world-class research infrastructures; – opening up to a greater utilisation of large-scale S&T infrastructures.
Science and society: various actions for a better integration of science in society and society in science through a more dynamic interaction between scientists, policy-makers, stakeholders and the public. (www.cordis.lu/fp6/society.htm)	– policy decisions more soundly based on science and more effective in meeting society's needs; – increased young people's interest in S&T studies and up-take of scientific careers, in particular by women through mainstreaming of gender equality throughout the European research system.

Instruments/actions of the 6th Framework Programme	Expected impacts
Co-ordination of national, regional and European activities in the field of research and innovation (including joint programmes and mutual opening). (www.cordis.lu/fp6/coordination.htm)	Increased complementarity and synergy between national or regional programmes, and between Community actions and those of other European scientific organisations, leading to: – more effective allocation of resources at European level; – world-level capabilities in a broader range of technological areas (excellence and critical size); – increased transfer and use of knowledge across Europe.
European information system on national programmes and policies.	User-friendly access to regularly up-dated information facilitating programme and policy co-ordination.
Coherent development of research and innovation policies: – regular monitoring through indicators and analyses; – support to the development of a wider foresight/ anticipatory culture in Europe; – application of the Open Method of Co-ordination, including mapping activities and mutual learning through benchmarking; – identification and analysis of regulatory and administrative obstacles and policy implications. (www.cordis.lu/fp6/policies.htm; www.jrc.es)	– more effective and coherent national and regional research and innovation policies; – improved framework conditions for investment in research and innovation through a better integration of research and innovation aspects in other policies.

5. Need for an open method of co-ordination for the "3% objective"

As shown by the Commission communication "More Research for Europe: Towards 3% of GDP", attaining the 3% objective relies largely on determined efforts to be carried out at the level of Member States. Therefore, to enable the European Council to follow progress towards its R&D objective, we need a collective process of monitoring and reporting on national policies and initiatives, the implementation of the action plan and the resulting progress at national and EU levels. This process should be complemented by benchmarking exercises focused on specific topics, where there is a particular need for detailed data gathering and information sharing and for the identification and dissemination of good practice.

Such a monitoring, reporting and benchmarking process will facilitate mutual learning between Member States in their actions to increase and improve R&D investment. It will also help increasing the effectiveness of these actions by ensuring, on a voluntary basis, greater consistency with each other and with related Community actions.

Complementarity and consistency will be ensured with the existing mutual learning processes, in particular in the area of innovation policy and human resources.

The open method of co-ordination defined in Lisbon appears to offer an appropriate framework for the monitoring, reporting and benchmarking needs related to the 3% objective, as suggested by the European Council conclusions of 21 March 2003.

5.1 PROPOSED PRINCIPLES FOR THE OPEN PROCESS OF CO-ORDINATION APPLIED TO THE "3% OBJECTIVE"

A flexible application of the principles established in Lisbon

As decided by the Lisbon European Council, the open method of co-ordination, "which is designed to help Member States to progressively develop their own policies, involves:

- fixing guidelines for the Union combined with specific timetables for achieving the goals which they set in the short, medium and long terms;
- establishing, where appropriate, quantitative and qualitative indicators and benchmarks against the best in the world and tailored to the needs of different Member States and sectors as a means of comparing best practice;
- translating these European guidelines into national and regional policies by setting specific targets and adopting measures, taking into account national and regional differences;
- periodic monitoring, evaluation and peer review organised as mutual learning processes."[13]

In the case of the 3% objective, the process should be flexible enough to reflect differences in national circumstances and policy priorities. In addition, in keeping with the Council conclusions of 26 November 2002, it should be organised on a voluntary basis and its administrative burden on Member States should be minimised.

It should thus be applied as follows:

- the **goals** for the Union are the 3% and 2/3 objectives fixed by all Member States in Barcelona; **guidelines** for the Union are, in effect, proposed by the present action plan;
- a limited set of **existing indicators** is proposed below; it is proposed for the agreement of Member States as reference indicators for the monitoring of progress towards the objectives;

(13) Presidency conclusions of the Lisbon European Council, 23-24 March 2000.

– Member States (and the regions that so wish) should be invited to set **national** (and regional) **targets** for R&D intensity and the share of business funding, as well as, where appropriate and on a voluntary basis, for other reference indicators, and to adopt the policy measures they deem appropriate;
– **monitoring, reporting and mutual learning** should be organised at two levels: an overall monitoring and reporting process, to which all Member States should participate, and **focused benchmarking exercises** in which Member States will be invited to take part on a voluntary basis.

Each Member State should be expected to contribute the minimum information indispensable for the **monitoring and reporting** of progress towards the objective, consisting of simple information on national policies and initiatives and on the limited set of existing indicators.

Existing and proven **structures** should be relied upon. However, they should be encouraged to have recourse to appropriate expertise, and to seek inter-ministerial co-ordination wherever necessary, for subjects related to the 3% objective that may not lie entirely within their competence.

Acceding and Candidate Countries are invited to take part in the open co-ordination process.

Administrative cost on Member States should be kept a minimum

Although **monitoring** has to rely on information provided to Member States, the process can be lightened by relying on a simple common framework for information collection agreed with Member States, and on existing indicators. These indicators may need to be complemented notably by way of surveys to collect more recent data (e.g. on trends in industrial R&D investments). Such complementary work would be organised and supported by the Community.

Benchmarking exercises in relation to the 3% objective may be supported by external expert groups and/or studies supported by the Community. This will allow notably for the collection of information and data related to countries not participating in a benchmarking exercise.

Reporting on national progress should be ensured by the Commission on the basis of information collected from Member States. It should form part of wider Commission reports covering also European-level actions contributing to the "3% objective".

Timetable

As the "3% objective" is part of the Lisbon process, the open co-ordination should be organised by **annual cycles**, with annual reports feeding the Commission reports to the Spring European Councils. In line with the recently streamlined co-ordination in the areas of economic and employment policies, annual progress reports would be complemented by a thorough overall reappraisal every three years.

Annual reports should be available by mid-November, in time for the preparation of the Commission Spring reports. This means that the relevant information should be made available by Member States two months earlier (by mid-September) at the latest.

Benchmarking cycles should be organised in such a way that elements related to the "3% objective" are made available according to this timetable.

Choice of reference indicators and standard policy information

A variety of reference indicators are necessary given the scope of the "3 % objective". They should nevertheless be kept within a manageable number – see 22 indicators proposed in Table 5.2.1 of section 5.2. The Commission proposal below is based on the relevance of indicators, their availability and their coverage of the various issues (input and output indicators).

The contents and format of the minimum policy information that all Member States will be invited to share should be agreed by Member States on the basis of a Commission proposal.

Choice of subjects for benchmarking

After consultation of Member States, the Commission will propose a limited number of focused topics for benchmarking, to which countries may participate on

a case by case and voluntary basis. The choice of topics should be based on their relevance and focus on well-defined issues. The first topics would include issues for which recent study and expert group reports initiated by the Commission constitute a good base for focused benchmarking, such as the effectiveness of public financing instruments for R&D and IPR issues in publicly funded research and in industry/university relations. Other benchmarking topics, on which work will be initiated in the first year or in subsequent years, will be selected in consultation with Member States.

5.2 REFERENCE INDICATORS FOR MONITORING AND REPORTING ON PROGRESS

A set of 22 indicators is proposed in Table 5.2.1 to help monitor and report on progress towards the 3% objective at national and EU levels. The list includes input as well as output indicators which are grouped into 6 categories: investment, human resources, innovation potential, business innovation, competitiveness. Two "composite" indictors are also included.

The selection was limited to indicators for which comparable statistical information is collected regularly. Most of the indicators are already used in one or several of the following Commission publications.

- DG Enterprise: European Trend Chart on Innovation[14];
- DG Education and Culture: Communication from the Commission - *European benchmarks in education and training: follow-up to the Lisbon European Council* (COM (629), 20/11/2002)[15];
- DG Economics and Financial Affairs: Structural Indicators[16] included in the statistical annex to the annual Report from the Commission to the Spring European Council[17].

The data for these indicators are from the following organisations:

- Statistical Office of the European Communities (Eurostat)[18];
- Organisation for Economic Cooperation and Development (OECD)[19];
- United Nations Statistics Division (Commodity Trade Database)[20];
- National Institute of Science and Technology Policy (NISTEP)[21];
- European Venture Capital Association (EVCA)[22:.
- National Venture Capital Association (NVCA)[23];
- European Patent Office (EPO)[24];
- United States Patent and Trademark Office (USPTO)[25].

(14) ftp://ftpnl.cordis.lu/pub/trendchart/reports/documents/report4.pdf
(15) http://europa.eu.int/comm/education/keydoc/2002/bench_en.pdf
(16) http://europa.eu.int/comm/eurostat/structuralindicators
(17) http://europa.eu.int/comm/lisbon_strategy/index_en.html
(18) http://europa.eu.int/comm/eurostat/
(19) http://www.oecd.org/
(20) http://unstats.un.org/unsd/comtrade/
(21) http://www.nistep.go.jp/
(22) http://www.evca.com/html/home.asp
(23) http://www.nvca.org/
(24) http://www.european-patent-office.org/
(25) http://www.uspto.gov

Table 5.2.1: Reference Indicators			
	No.	**Indicator**	**Comment**
Investment	**1**	Indicator 1: Share of Gross domestic expenditure on R&D (GERD) in gross domestic product (GDP).	R&D intensity of the economy (Barcelona objective: 3% by 2010).
	2	Indicator 2: Gross domestic expenditure on R&D (GERD) as a percentage of GDP by source of fund (government, business enterprise sector, other national sources and abroad).	Share of R&D financed by different institutional sectors (Barcelona objective: 2/3rds financed by the private sector by 2010).
	3	Indicator 3: Share of business enterprise expenditure on R&D (BERD) in Gross domestic expenditure in R&D (GERD).	Relative importance of the R&D executed by business enterprises in the total R&D investment.
		Indicator 3': Share of R&D executed in business sector (BERD) financed by government.	Relative importance of public funding in R&D performed by business enterprise sector (excluding fiscal incentives). Comparison with industry-financed R&D.
	4	Indicator 4: Share of Small and Medium Enterprises (SMEs) in R&D executed by the business enterprise sector and financed by government.	Participation of SMEs vs. large firms in national R&D programmes.
	5	Indicator 5: R&D intensity (R&D expenditure as a percentage of value added), R&D expenditure as a percentage of GDP and value added as a percentage of GDP, across industries in manufacturing.	Sectorial analysis of R&D executed by manufacturing industry (Sectors' R&D intensities, sizes and contributions to total R&D expenditure). Comparison EU, US and Japan.
		Indicator 5': R&D intensity (R&D expenditure as a percentage of value added) and R&D expenditure as a percentage of GDP in some high-tech sectors, by country.	Sectorial analysis of R&D in high-tech sectors. Comparison between Member States.
Human resources	**6**	Indicator 6: Share of total tertiary education expenditure in GDP.	Relative importance of resources affected to the human capital as a source of future knowledge workers who may become researchers and create and diffuse new knowledge (the Barcelona objective creates a high demand for human resources in science and technology (HRSTs)).
	7	Indicator 7: Share of researchers (research scientist & engineers or RSEs) in population.	Relative importance of S&T-trained researchers in the population.
	8	Indicator 8: Share of R&D personnel in labour force by institutional sector.	Distribution of RSEs and other R&D personnel in the different institutional sectors.
	9	Indicator 9: R&D expenditure by researcher (RSE) by institutional sector.	Means provided to researchers in different sectors (attractiveness of R&D careers).
	10	Indicator 10: Number of yearly new S&T PhDs in 25-34 years old population.	Capacity to produce highly trained individuals in S&T (potential future researchers).
	11	Indicator 11: Breakdown of employed human resources in S&T (HRST) according to their native country.	National characteristics in terms of mobility of researchers and R&D personnel (training; co-operation; acquisition and dissemination of knowledge).

	No.	Indicator	Comment
Innovation potential	12	Indicator 12: Number of patents respectively filed with the European Patent Office (EPO) and granted by the US Patent and Trademark Office (USPTO).	Output of R&D in terms of knowledge having a commercial exploitation potential.
	13	Indicator 13: Number of high-tech (HT) patents respectively filed with the EPO and granted by the USPTO per capita.	Output of R&D in terms of high-tech knowledge having a commercial exploitation potential. Comparison with output for all sectors.
Business innovation	14	Indicator 14: Share of seed & start up venture capital in GDP.	Relative dynamism of new business creation. Comparison with R&D intensity of the economy.
	15	Indicator 15: Share of seed & start-up in venture capital for all sectors and for high-tech sectors.	Equity financing of business creation vs. expansion. Comparison of all sectors with high tech sectors. Creation and expansion of R&D intensive firms.
	16	Indicator 16: Expenditure on innovation in turnover of manufacturing industry.	Intensity of innovation related activities in manufacturing industry (creation, diffusion and absorption of knowledge).
	17	Indicator 17: SMEs innovating in-house (% of manufacturing SMEs).	Capacity of manufacturing SMEs to innovate.
	18	Indicator 18: Innovative co-operating SMEs (% of manufacturing SMEs).	Participation of manufacturing SMEs in innovation cooperation (diffusion of knowledge).
Competitiveness	19	Indicator 19: Technology balance of payments per capita.	International performance in technological knowledge exports and in acquisition of new knowledge through imports.
	20	Indicator 20: High-tech products imports and exports per capita.	Competitiveness of high-tech sectors in the global market (linked to country size).
Composite	21	Indicator 21: Composite indicator on investment in a knowledge-based economy.	Indicator that combines: GERD per capita, number of researchers per capita, new yearly S&T PhDs per capita, total education spending per capita, share of adult population participating in life-long learning, e-government (part of public services available on-line), gross fixed capital formation (excluding construction) per capita.
	22	Indicator 22: Composite indicator on performance in the transition to a knowledge-based economy.	Indicator that combines: GDP per hour worked, number of European and US patents per capita, number of scientific publications per capita, e-commerce (percentage of companies setting their products/services through electronic market places), schooling success rate.

5.3 SITUATION IN MEMBER STATES AND ACCEDING COUNTRIES

The following figures present, for each indicator of table 5.2.1, the situation in Member States and, when data are available, in Acceding Countries. Where possible, data on the United States and Japan are also presented for comparison.

In all figures, data for the EU (European Union) have been calculated for the EU Member States (EU-15), due to the incompleteness of data available for Acceding Countries.

Country codes used in the figures, according to Eurostat nomenclature, are:

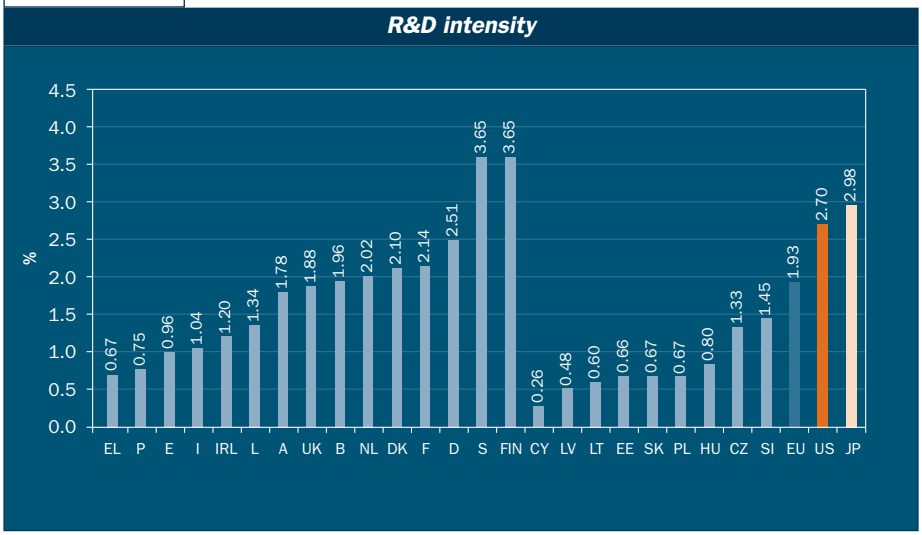
– the 15 Member States: B: Belgium; DK: Denmark; D: Germany; EL: Greece; E: Spain; F: France; IRL: Ireland; I: Italy: L: Luxembourg; NL: Netherlands; A: Austria; P: Portugal; FIN: Finland; S: Sweden; UK: United Kingdom;

– Acceding Countries: CY: Cyprus; CZ: Czech Republic; EE: Estonia; HU: Hungary; LT: Lithuania; LV: Latvia; MT: Malta; PL: Poland; SI: Slovenia; SK: Slovak Republic;

– other countries: US: United States; JP: Japan.

Indicator 1: R&D intensity (Gross domestic expenditure on R&D (GERD)/GDP)

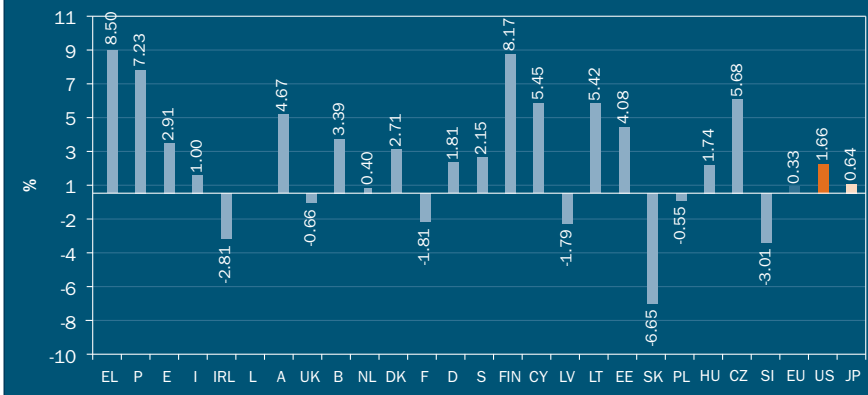
Figure 5.3.1.1



Sources: DG Research
Data: Eurostat, Member States. Years: A: 1998; B, EL, IRL, I, NL, P, S: 1999; D, E, FIN, EU: 2001; UK: 2002; others: 2000
Note: EU average is an estimate for EU-15 and does not include L. The R&D intensity in 2000 is 1.87 for EU-25 and 1.92 for EU-15.

Figure 5.3.1.2

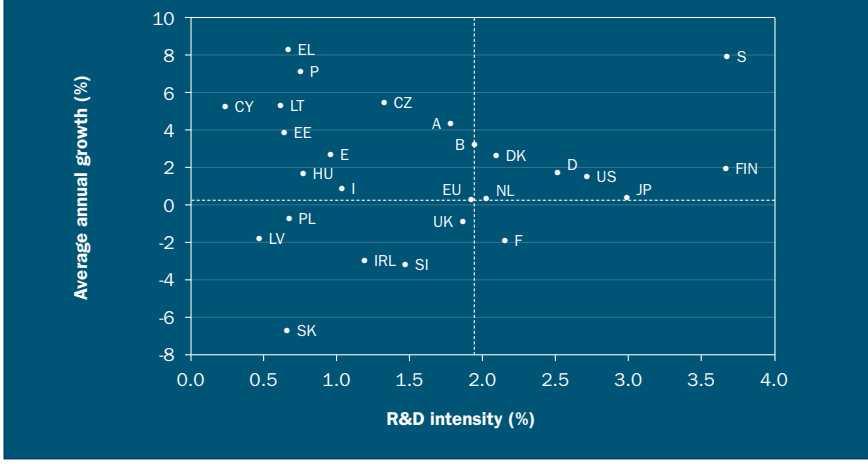
R&D intensity, average annual real growth rate



Source: DG Research
Data: Eurostat, Member States. Years: from 1995 (except CY, EE: 1998) to latest available year (see 5.3.1.1)
Note: see figure 5.3.1.1

Figure 5.3.1.3

R&D intensity vs. R&D intensity average annual growth rate

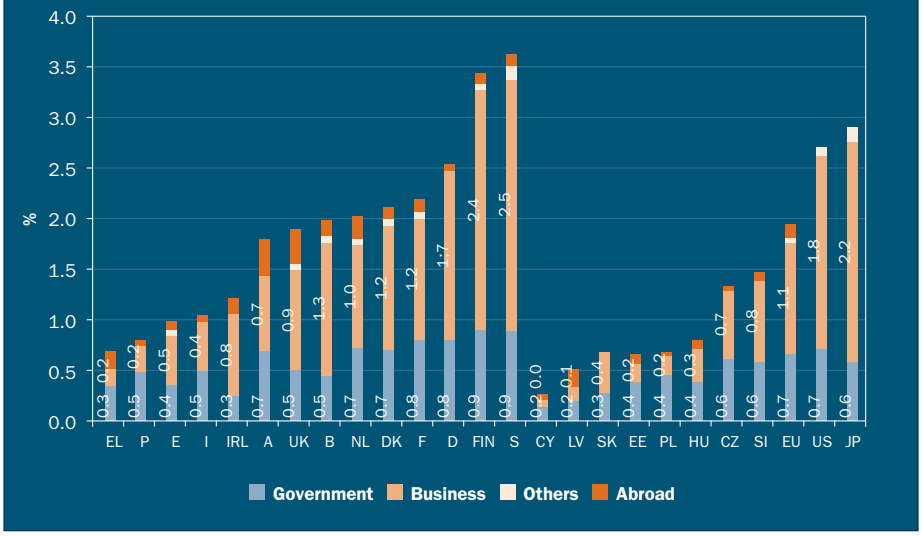


Source: DG Research – Data: Eurostat, Member States
Note: Years are the same as for figures 5.3.1.1 and 5.3.1.2

Indicator 2: Gross domestic expenditure on R&D (GERD) as a percentage of GDP by source of fund: government, business enterprise sector, other national sources and abroad

Figure 5.3.2.1

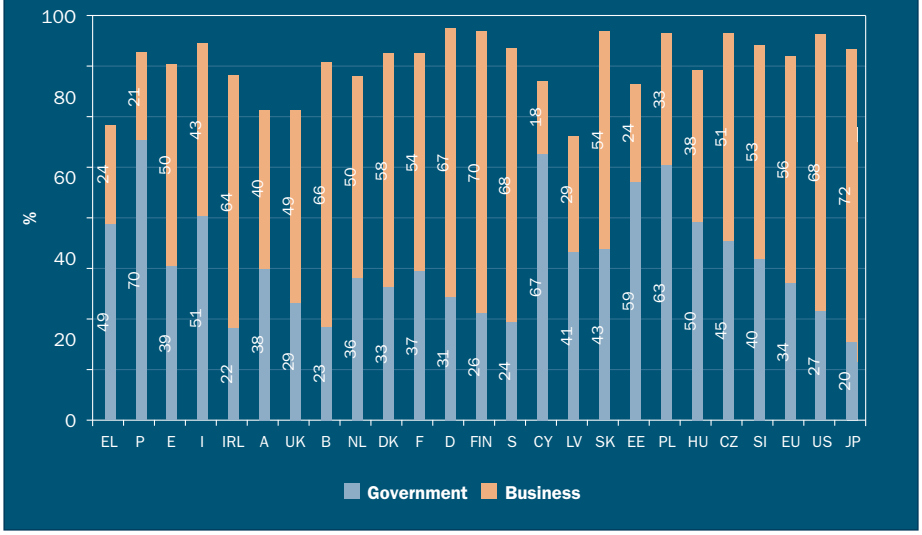
R&D intensity by source of fund



Source: DG Research
Data: OECD, Eurostat. Years: B, DK, EL, F, IRL, I, NL, P, S, UK: 1999; D: 2001; others: 2000

Figure 5.3.2.2

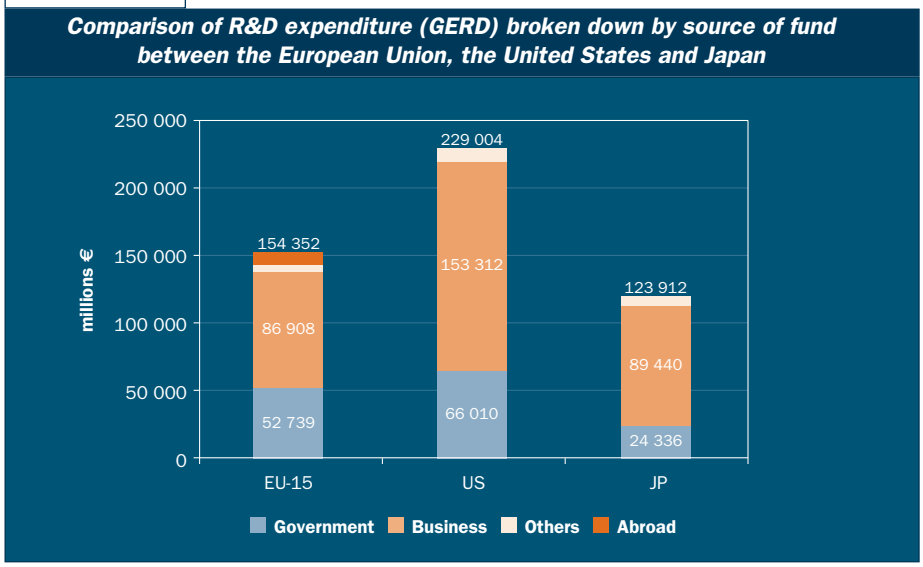
Share of GERD financed by government sector and by business enterprise sector



Source: DG Research
Data: OECD, Eurostat. Years: B, DK, EL, F, IRL, I, NL, P, S, UK, EU: 1999; D: 2001; others: 2000

Figure 5.3.2.3

Comparison of R&D expenditure (GERD) broken down by source of fund between the European Union, the United States and Japan

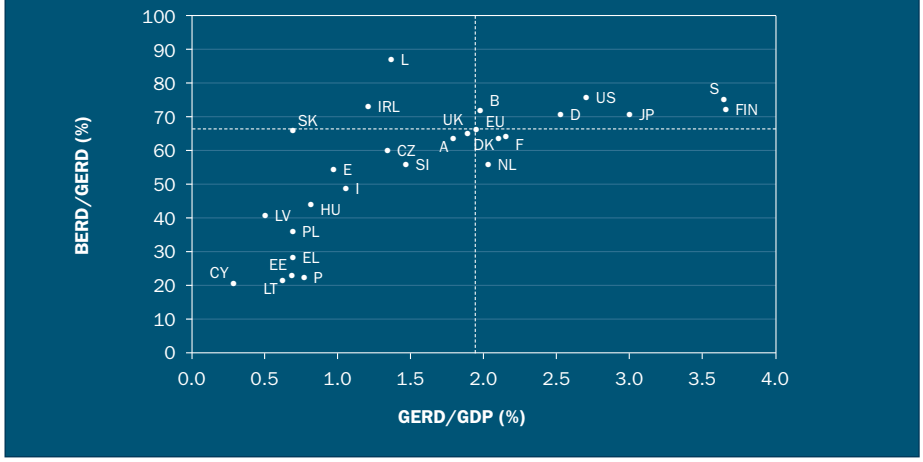


Source: DG Research
Data: OECD. Year: 1999
Note: Same as for figure 5.3.2.1

Indicator 3: Share of business enterprise expenditure on R&D (BERD) in Gross domestic expenditure in R&D (GERD)

Figure 5.3.3.1

GERD/GDP vs. BERD/GDP

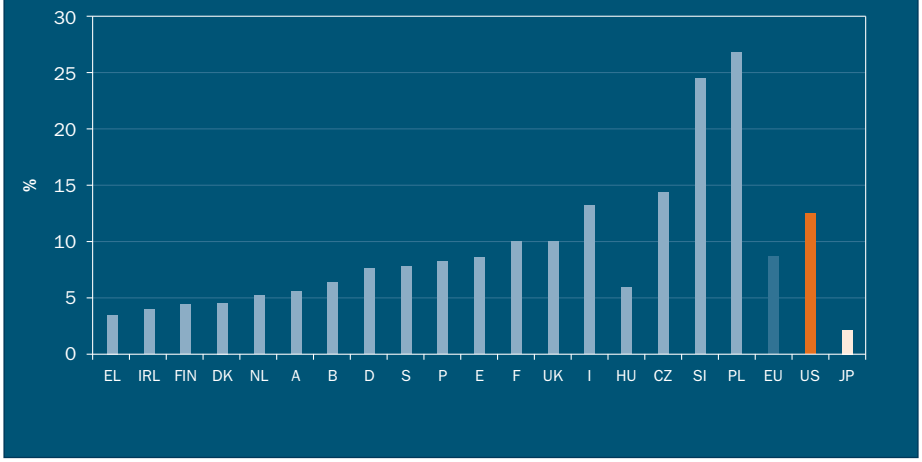


Source: DG Research
Data: Eurostat. Years: A: 1998; B, EL, IRL, I, NL, P, S: 1999; D, E, FIN, EU: 2001; UK: 2002; others: 2000

Indicator 3':Share of R&D executed in business sector (BERD) financed by government

Figure 5.3.3.2

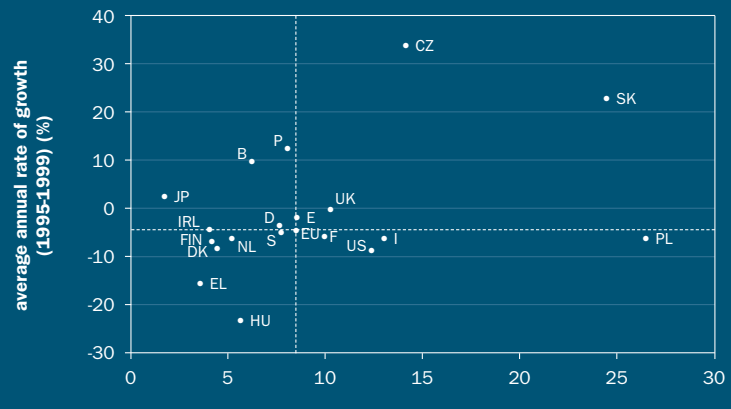
Share of BERD financed by government



Source: DG Research
Data: OECD. Year: 1999

Figure 5.3.3.3

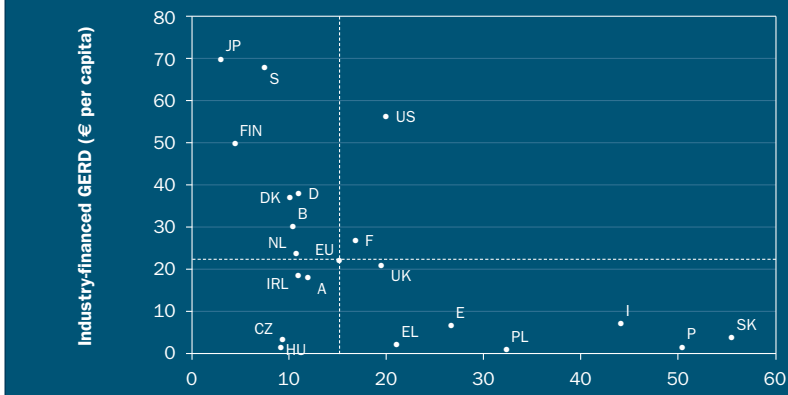
Share of BERD financed by government vs. its growth rate



Source: DG Research
Data: OECD

Figure 5.3.3.4

BERD financed by government per capita vs. industry-financed GERD per capita

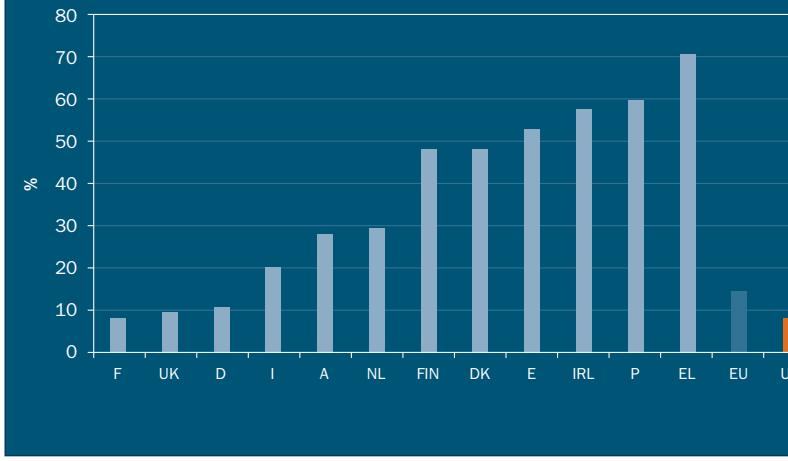


Source: DG Research
Data: OECD. Year: 1999

Indicator 4: Share of Small and Medium Enterprises (SMEs) in R&D executed by the business enterprise sector and financed by government

Figure 5.3.4.1

Share of SMEs in R&D executed by the business enterprise sector and financed by government

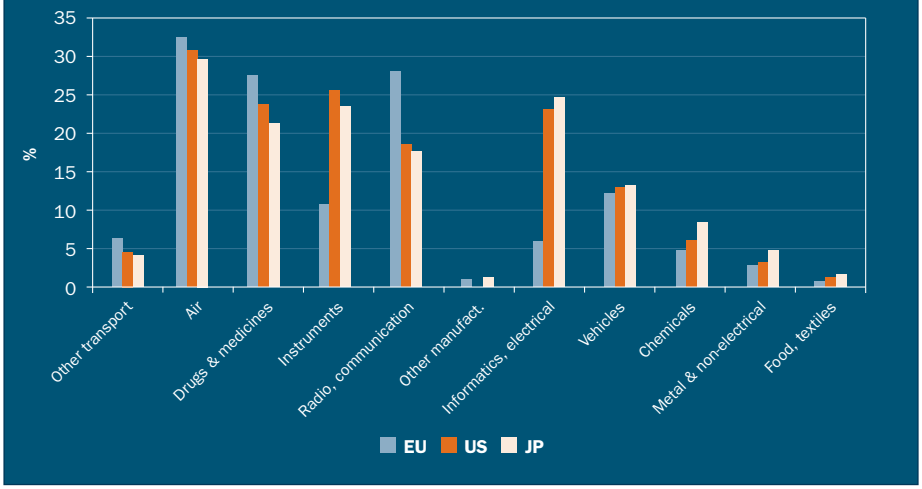


Source: DG Research, *Key Figures 2002*
Data: Eurostat. Years: IRL: 1997, A: 1998; others: 1999

Indicator 5: R&D intensity (R&D expenditure as a percentage of value added), R&D expenditure as a percentage of GDP and value added as a percentage of GDP, across industries in manufacturing.

Figure 5.3.5.1

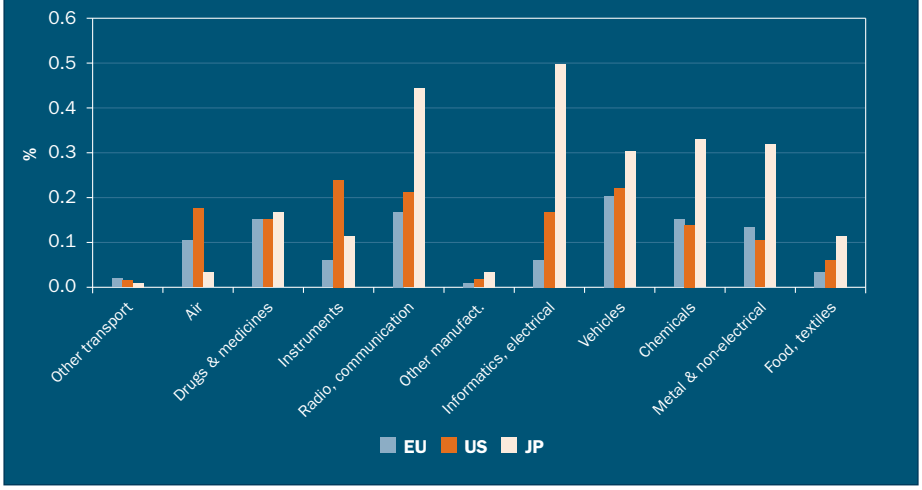
Sectoral R&D intensity (R&D expenditure as a percentage of value added)



Source: DG Research
Data: OECD (ANBERD, STAN), Eurostat. Year: 1998
Note: Sectors are ranked according to increasing European Union value added

Figure 5.3.5.2

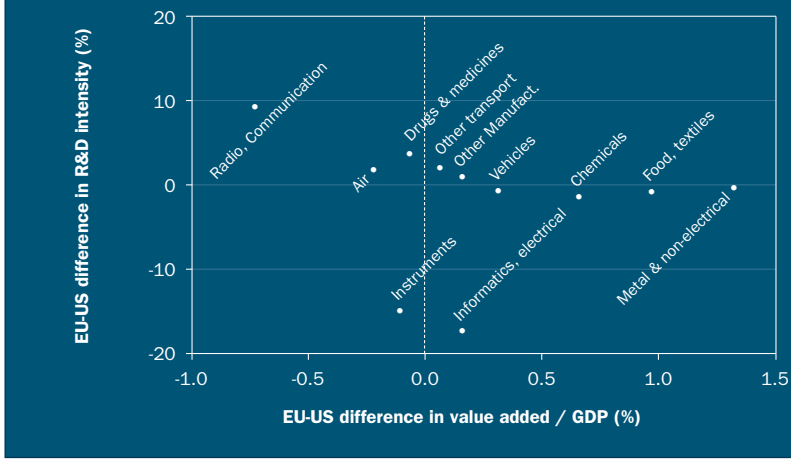
Figure 5.3.5.2: sectoral BERD/GDP



Source: DG Research
Data: OECD (ANBERD, STAN), Eurostat. Year: 1998
Note: Sectors are ranked according to increasing European Union value added

Figure 5.3.5.3

Difference (EU-US): Value added/GDP vs. R&D intensity

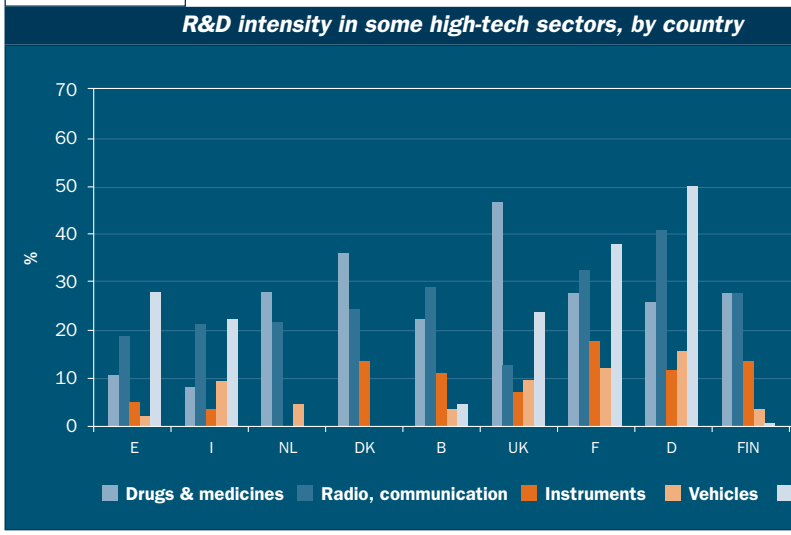


Source: DG Research
Data: OECD (ANBERD, STAN), Eurostat. Year: 1998
Note: Positive values correspond to higher R&D intensity and value added/GDP in the EU than in the US.

Indicator 5': R&D intensity (R&D expenditure as a percentage of value added) and R&D expenditure as a percentage of GDP in some high-tech sectors, by country

Figure 5.3.5'.1

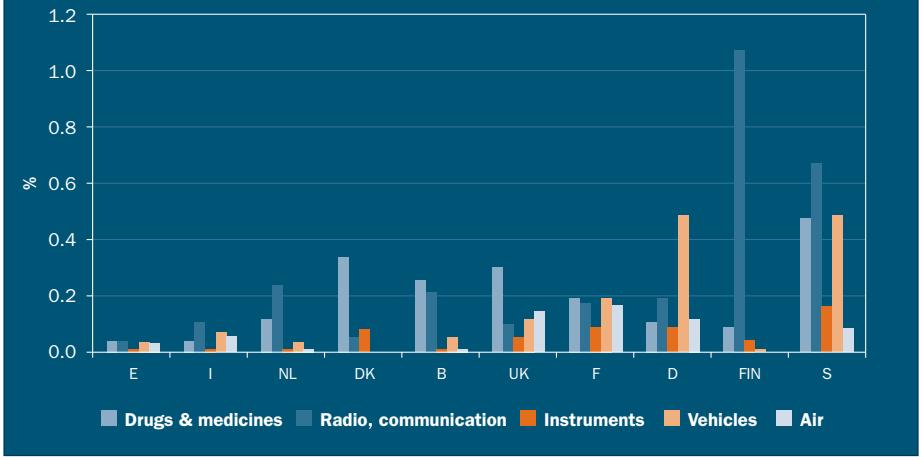
R&D intensity in some high-tech sectors, by country



Source: DG Research
Data: OECD (ANBERD, STAN), Eurostat. Year: 1998
Notes: Countries are ranked according to increasing contribution of selected manufacturing sectors to the BERD; data are not available for EL, IRL, L, A, P and for some sectors in DK and NL
See table 3.2.1 in *REIST3* for information on all sectors

Figure 5.3.5'.2

R&D expenditures as % of GDP in some high-tech sectors, by country

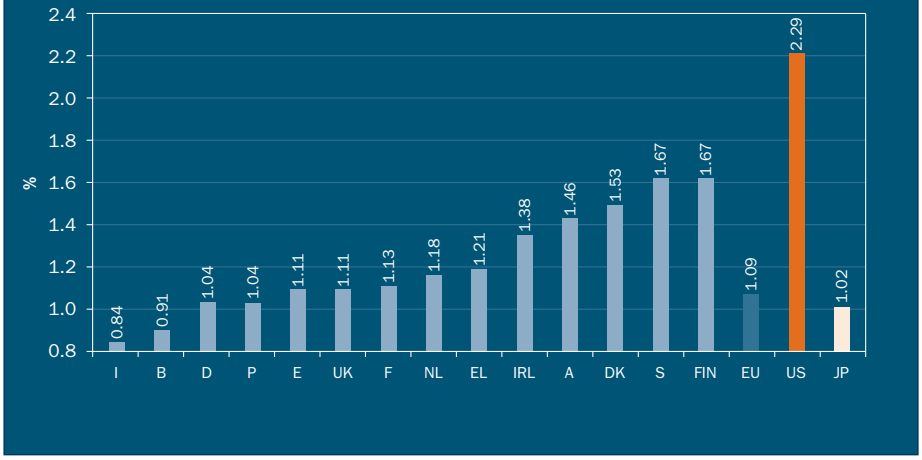


Source: DG Research
Data: OECD (ANBERD, STAN), Eurostat. Year: 1998
Notes: see figure 5.3.5'.1

Indicator 6: Share of total tertiary education expenditure in the GDP

Figure 5.3.6.1

Share of total tertiary education expenditure in the GDP

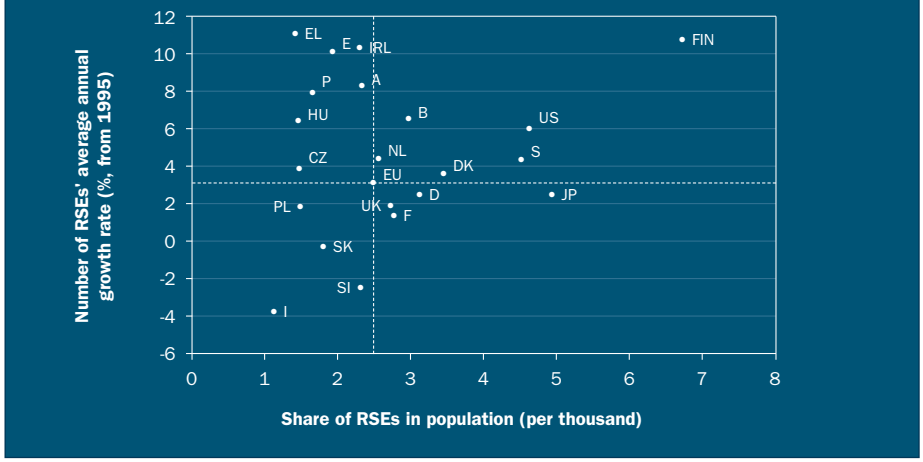


Source: *Key Figures 2002*, DG Research
Data: OECD. Year: 1998
Note: EU average does not include L. Total expenditure include public and private expenditure

Indicator 7: Share of researchers (research scientist & engineers or RSEs) in population

Figure 5.3.7.1

Share of RSEs in population vs. number of RSEs' annual growth

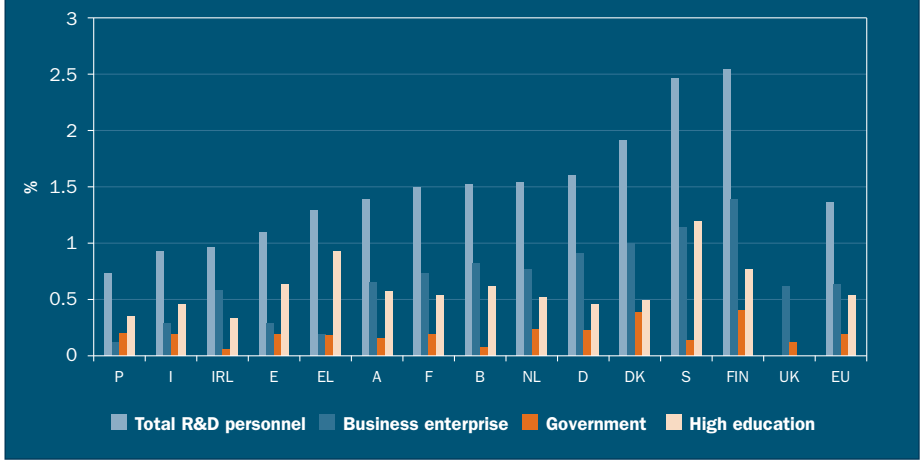


Source: DG Research
Data: Eurostat, DG Research. Years: CZ, PL, SK: 2001; E, P, FIN, JP, HU, SI: 2000; others: 1999

Indicator 8: Share of R&D personnel in labour force by institutional sector

Figure 5.3.8.1

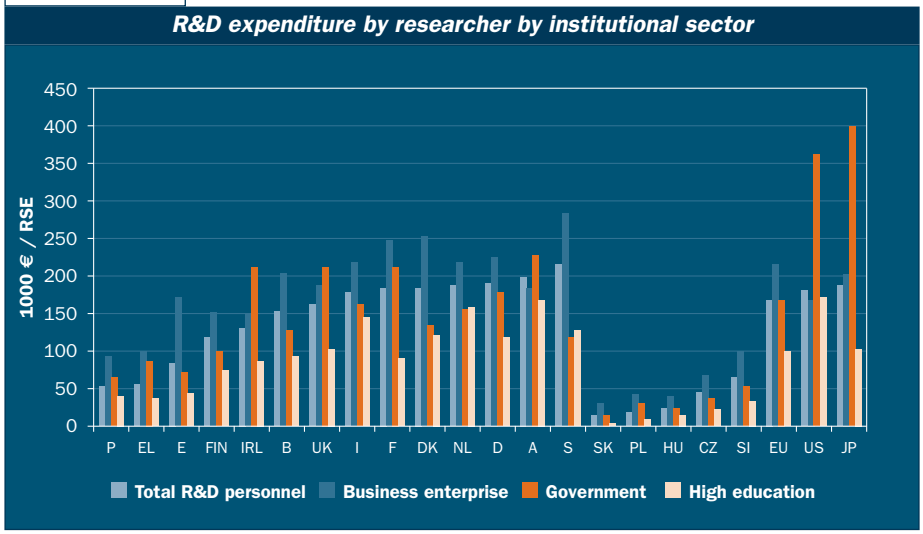
Share of R&D personnel in labour force by institutional sector



Source: DG Research
Data: Eurostat, DG Research. Years: F, A: 1998; others: 1999
Notes: EU countries are ranked according to increasing "Total R&D personnel", except UK (missing data) and EU

Indicator 9: R&D expenditure by researcher (RSE: Research Scientists and Engineers) by institutional sector

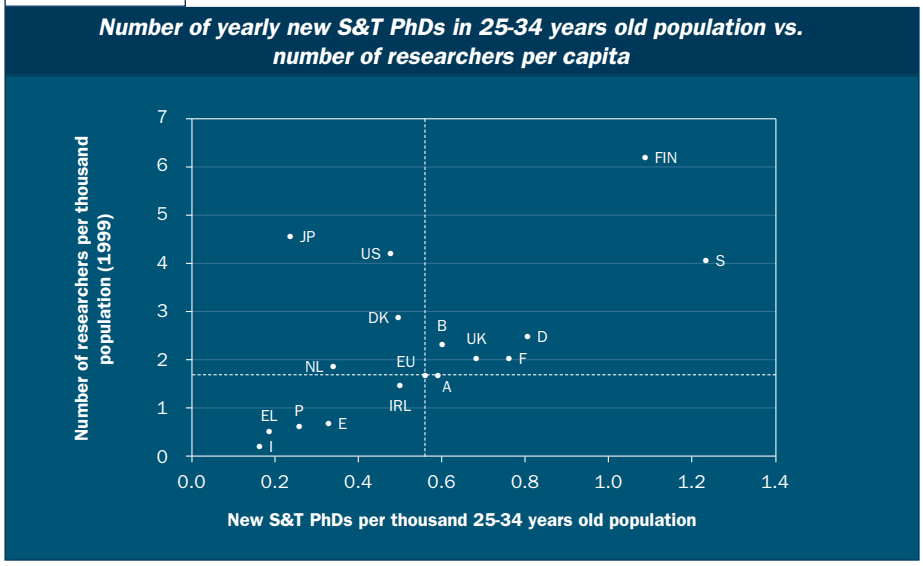
Figure 5.3.9.1



Source: DG Research
Data: Eurostat, OECD. Years: A: 1998; others: 1999
Notes: Member States and Acceding Countries are ranked according to increasing "Total" (average)

Indicator 10: Number of yearly new S&T PhDs in 25-34 years old population

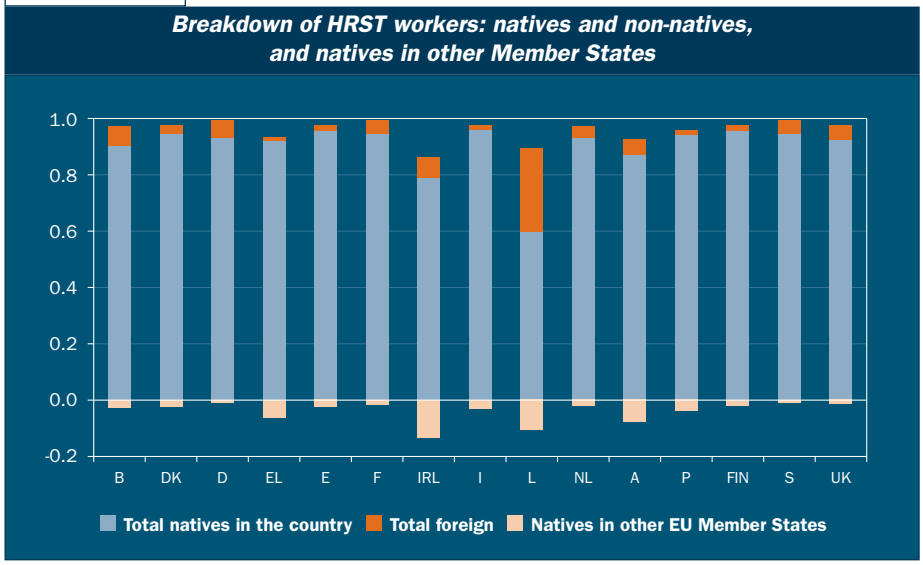
Figure 5.3.10.1



Sources: DG Research; REIST3, DG Research
Data: Eurostat
EL, I: 1999; others:2000
The value for EU does not include L

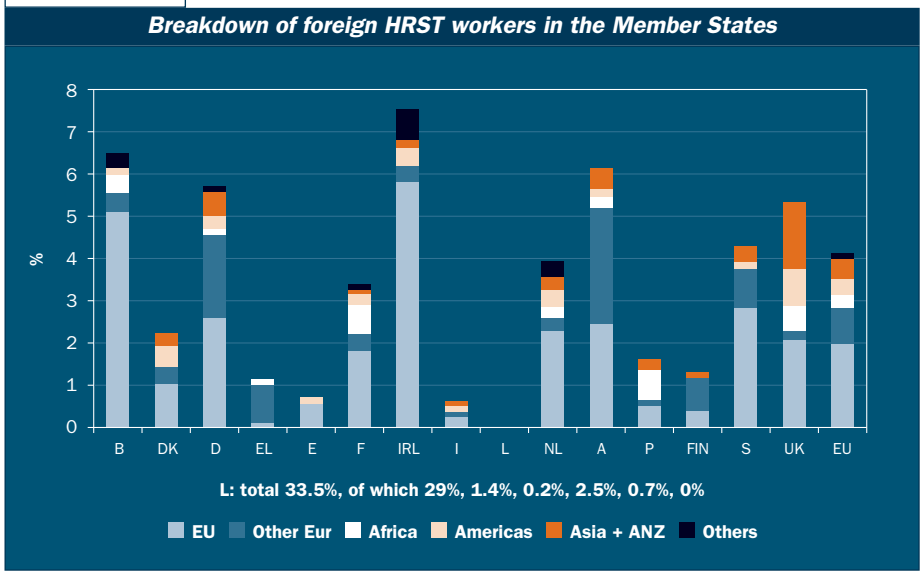
Indicator 11: Breakdown of employed human resources in S&T (HRST) according to their native country

Figure 5.3.11.1



Source: DG Research
Data: Eurostat, Labour Force Survey. Year: 2000
Note: Total is 100% for each country; it does not include EU natives working outside the EU-15

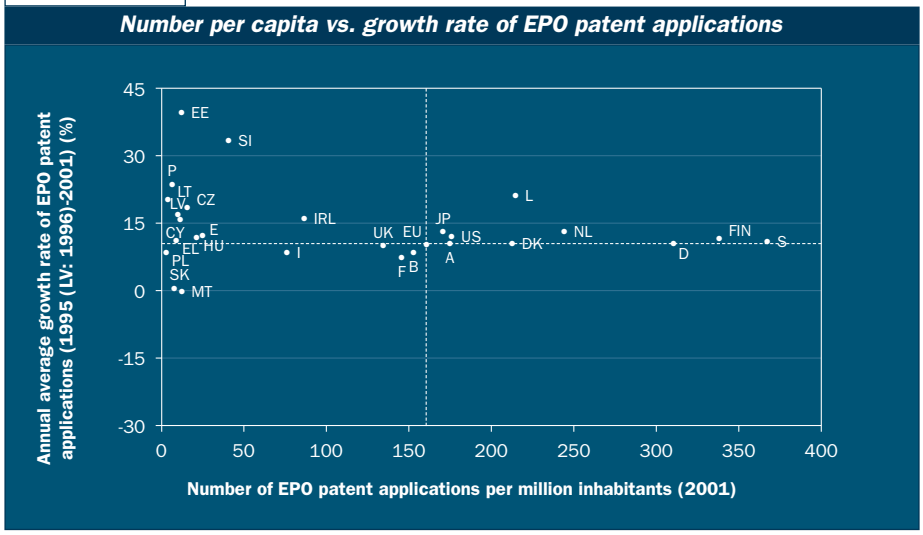
Figure 5.3.11.2



Source: DG Research
Data: Eurostat, Labour Force Survey. Year: 2000

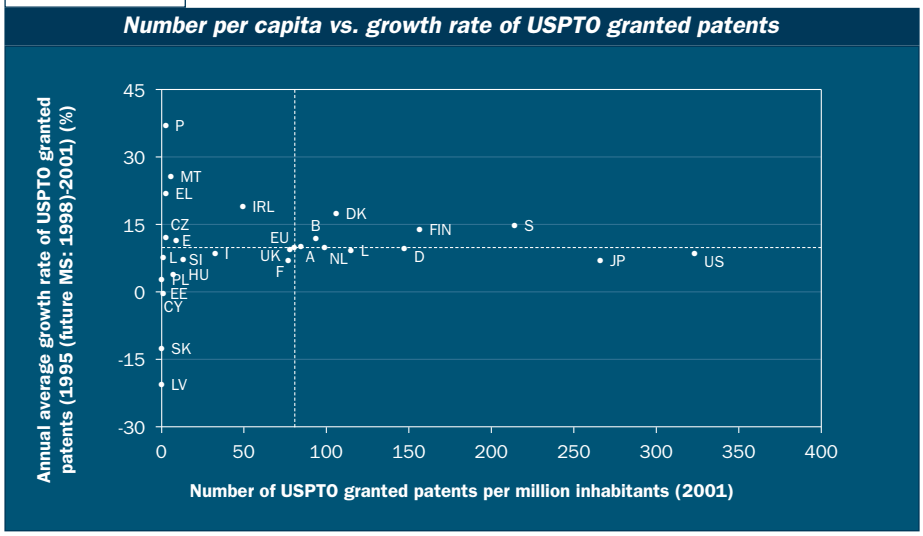
Indicator 12: Number of patents respectively filed with the European Patent Office (EPO) and granted by the US Patent and Trademark Office (USPTO)

Figure 5.3.12.1



Source: DG Research
Data: EPO
Note: growth rate not available for MT

Figure 5.3.12.2

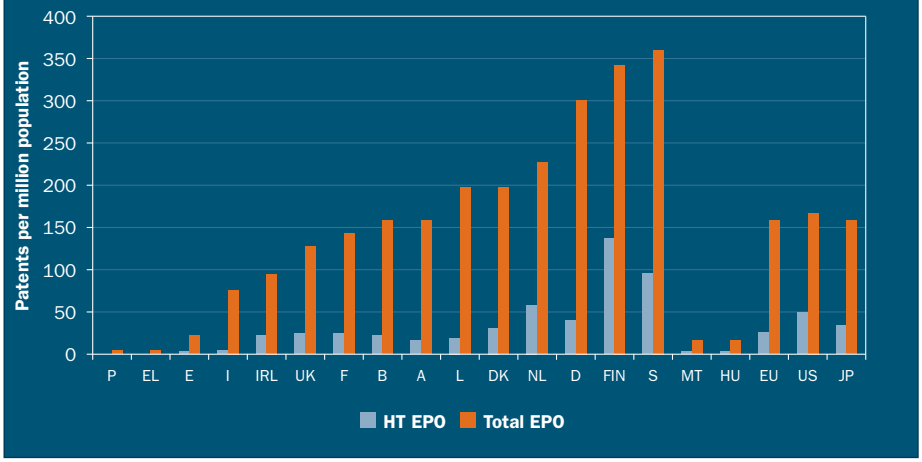


Source: DG Research
Data: USPTO
Note: growth rate not available for EE

Indicator 13: Number of high-tech (HT) patents respectively filed with the EPO and granted by the USPTO per capita

Figure 5.3.13.1

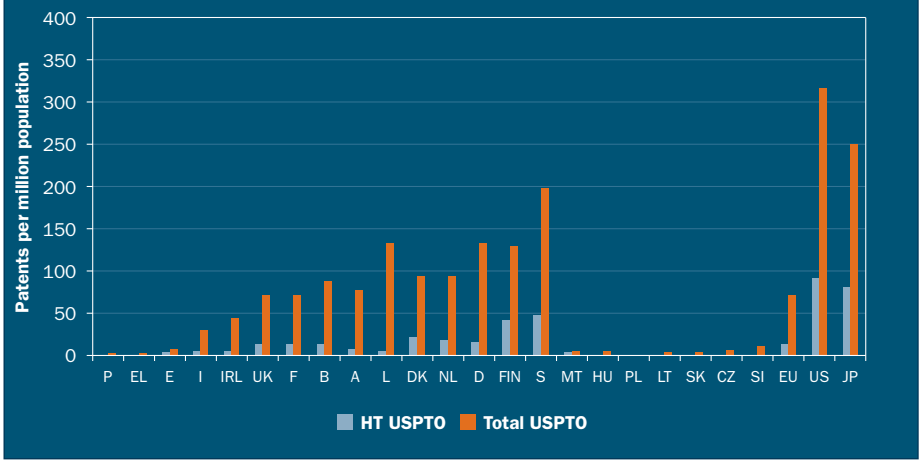
Number of EPO total and high-tech patent applications per capita



Sources: for "total patents", *Key Figures 2002*, DG Research; for "high-tech patents", "2002 European Innovation Scoreboard", *Trend Chart on Innovation*, DG Enterprise
Data: EPO, Eurostat. Years: MT: 1999; others: 2000

Figure 5.3.13.2

Number of USPTO total and high-tech granted patents per capita

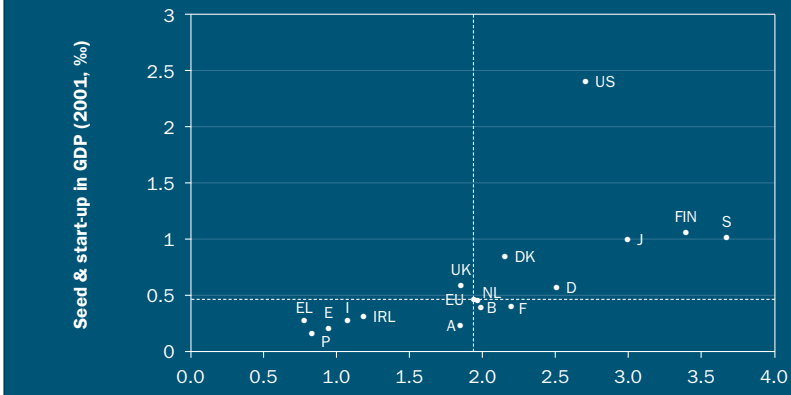


Sources: for "total patents", *Key Figures 2002*, DG Research; for "high-tech patents", "2002 European Innovation Scoreboard", *Trend Chart on Innovation*, DG Enterprise
Data: EPO, Eurostat. Years: LT: 1998; SK: 1999; MT: 2001; others: 2000
Note: Member States and Acceding Countries are ranked, as in 5.3.13.1, according to increasing total EPO patents applications per capita

Indicator 14: Share of seed & start up venture capital in GDP

Figure 5.3.14.1

R&D intensity vs. share of seed & start-up venture capital in GDP

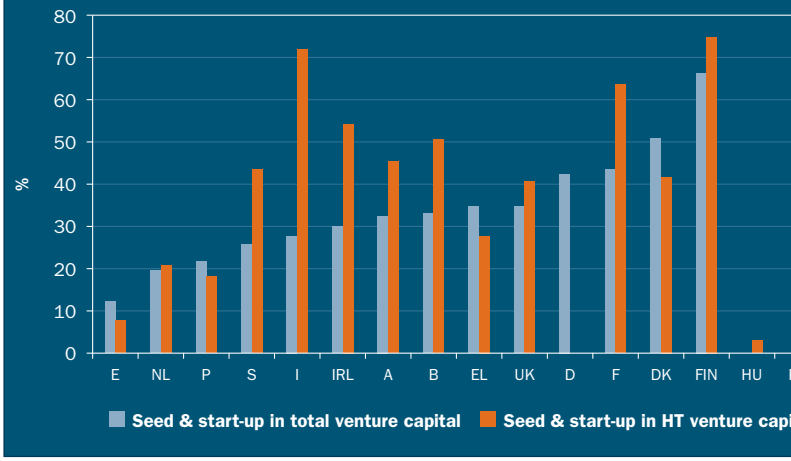


Source: *REIST3*, DG Research
Data Eurostat, EVCA, NVCA, NISTEP, OECD

Indicator 15: Share of seed & start-up in venture capital for all sectors and for high-tech sectors

Figure 5.3.15.1

Share of seed & start-up in venture capital for all sectors and for high-tech sectors

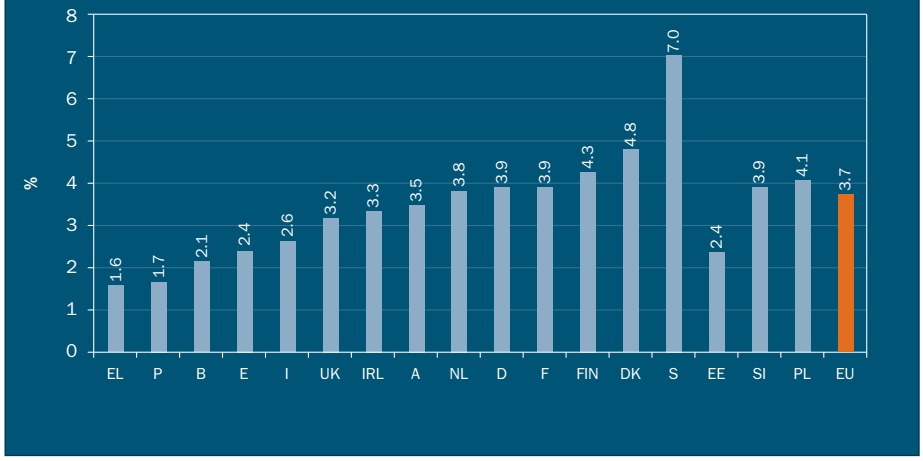


Source: DG Research
Data Eurostat, EVCA, NVCA, NISTEP, OECD (used in *REIST3*). Years: total sectors: 2001; high-tech sectors: 1st semester 2001
Notes: Venture capital is defined as the sum of seed, start-up and expansion stages of private equity investment (cf. *REIST3*, p. 153). Data not available for D (total sectors), HU and PL (high-tech sectors)

Indicator 16: Share of expenditure on innovation in turnover of manufacturing industry

Figure 5.3.16.1

Share of expenditure on innovation in turnover of manufacturing industry

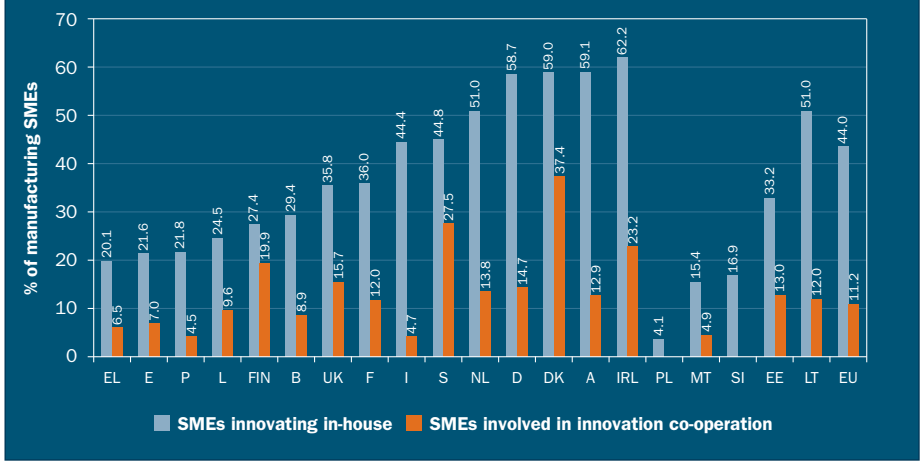


Source: "2002 European Innovation Scoreboard", *Trend Chart on Innovation*, DG Enterprise
Data: Eurostat, 2nd Community Innovation Survey (CIS), GSO survey for EE. Years: EE, PL, SI: 2000; D, E, EL: 1998; others: 1996.
This indicator will be updated as soon as results from 3rd CIS will be available

Indicator 17: SMEs innovating in-house (% of manufacturing SMEs) and indicator 18: Innovative co-operating SMEs (% of manufacturing SMEs)

Figure 5.3.17.1

Percentage of manufacturing SMEs: innovating in-house and involved in innovation co-operation

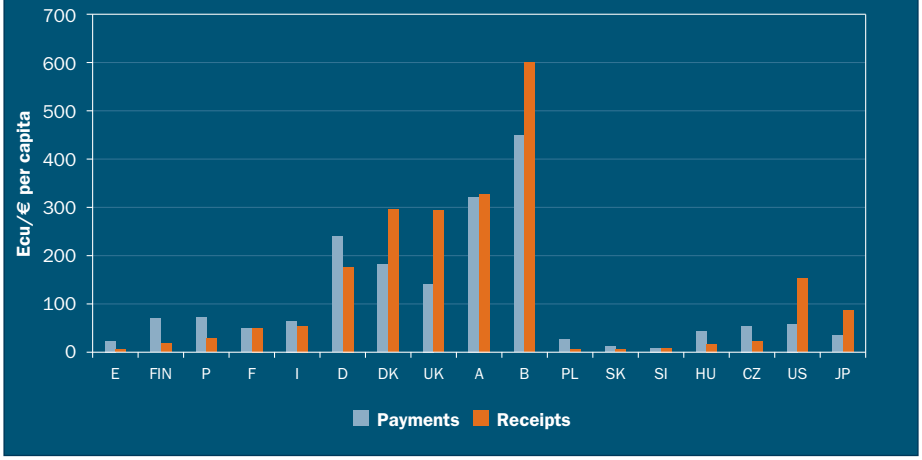


Source: "2002 European Innovation Scoreboard", *Trend Chart on Innovation*, DG Enterprise
Data: Eurostat, 2nd Community Innovation Survey, GSO survey for EE, LT, MT. Years: EE: 2000; LT, PL, SI: 1999; E, EL, MT, NL: 1998; others: 1996. This indicator will be updated as soon as results from 3rd CIS3 will be available
Note: Member States and Acceding Countries are ranked according to increasing "SMEs innovating in-house"

Indicator 19: Technology balance of payments per capita

Figure 5.3.19.1

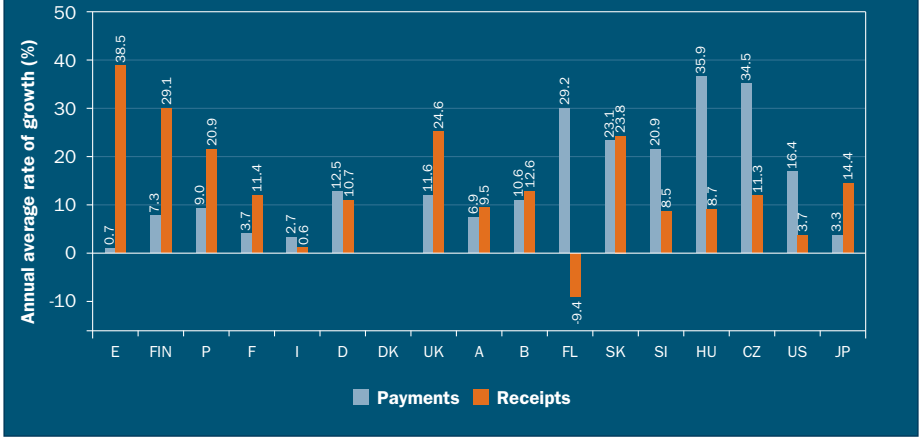
Payments and receipts of technology balance of payments per capita



Source: *Key Figures 2002*, DG Research
Data: OECD, Eurostat, Member States. Years: E, FIN: 1998; DK, CZ, HU: 1999; others: 2000
Note: Member States and Acceding Countries are ranked according to increasing receipts in technology balance of payments

Figure 5.3.19.2

Average annual growth rate of payments and receipts of technology balance of payments

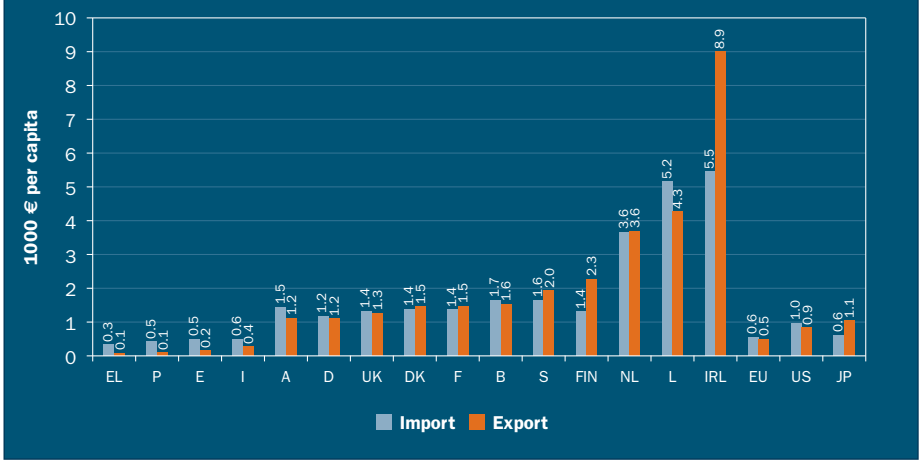


Source: *Key Figures 2002*, DG Research
Data: OECD, Eurostat, Member States. First years: DK: 1999; CZ: 1997; HU: 1996; others: 1995
Notes: Member States and Acceding Countries are ranked as in 5.3.19.1; calculated from data in constant national currencies

Indicator 20: High-tech products imports and exports per capita

Figure 5.3.20.1

High-tech products imports and exports per capita

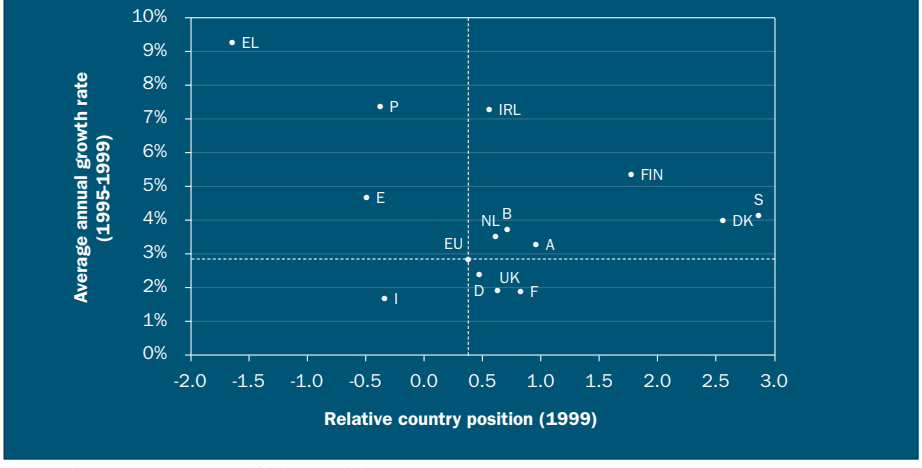


Source: DG Research
Data: Eurostat (Comext), UN (Comtrade)
Note: European countries are ranked according to increasing exports

Indicator 21: Composite indicator on investment in a knowledge-based economy

Figure 5.3.21.1

Composite indicator on investment in a knowledge-based economy, relative country positions vs. annual growth rate

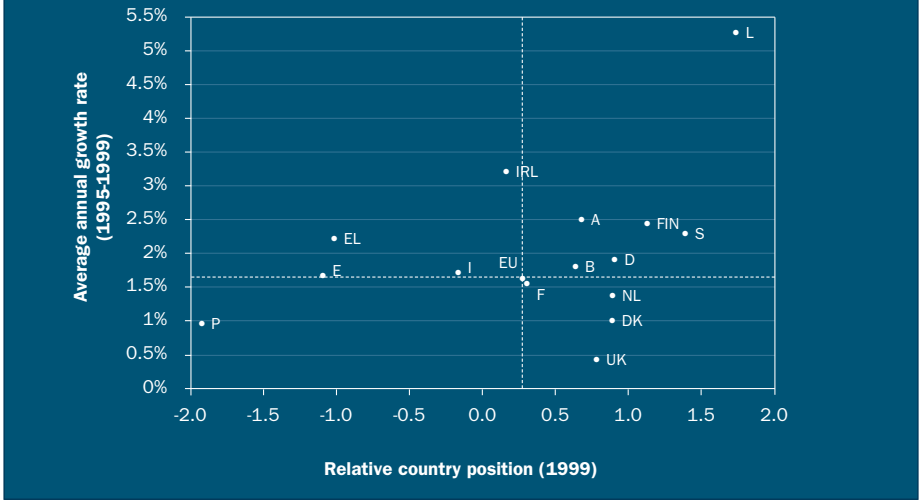


Source: DG Research *Key Figures 2002* and *REIST3*
Data: Eurostat, DG Information Society
Notes: Standardisation: for each sub-indicator, EU value is 0 and standard deviation is 1 in 1995; sub-indicators (weights related to the standardisation given between brackets, total 24): GERD per capita (2), number of researchers per capita (2), new yearly S&T PhDs per capita (4), total education spending per capita (7), share of adult population participating in life-long learning (3), e-government (part of public services available on-line) (3), gross fixed capital formation (excluding construction) per capita (3); e-government is not included in the comparison of the growth rates (data only for 1999); L not included

Indicator 22: Composite indicator on performance in the transition to a knowledge-based economy

Figure 5.3.22.1

Composite indicator on performance in the transition to a knowledge-based economy, relative country positions vs. annual growth rate



Source: DG Research *Key Figures 2002* and *REIST3*
Data: Eurostat, EPO, USPTO, ISI/CWTS, DG Information Society
Note: Standardisation: for each sub-indicator, EU value is 0 and standard deviation is 1 in 1995; sub-indicators (weights related to the standardisation given between brackets, total 8): GDP per hour worked (2), number of European and US patents per capita (1), number of scientific publications per capita (1), e-commerce (percentage of companies setting their products/services through electronic market places) (2), schooling success rate (2)

6. European Technology Platforms

In domains where RTD has a vital role to play in addressing major economic, technological or societal challenges, and their interplay in a sustainable development perspective, European Technology Platforms can provide a means to foster effective public-private partnerships between the research community, industry and policy makers in order to deliver the impetus to mobilise the research and innovation effort towards achieving a common goal. The role of Technology Platforms in stimulating more effective RTD, particularly in the private sector, can contribute directly to achieving the Lisbon objectives, developing the European Research Area and increasing investment in R&D towards the 3% of GDP target.

In essence, a Technology Platform (TP) is a mechanism to bring together all interested stakeholders to develop a long-term vision to address a specific challenge, create a coherent, dynamic strategy to achieve that vision and steer the implementation of an action plan to deliver agreed programmes of activities and optimise the benefits for all parties. The elaboration and follow-up of a **Strategic Research Agenda** form a crucial part of the implementation strategy, to optimise the contribution of RTD to the process. In achieving its wider goals, a TP should, in a medium to long term perspective, generate sustainable competitiveness and world leadership for the EU in the field concerned, by stimulating increased and more effective investment in R&D, accelerating innovation and eliminating the barriers to the deployment and growth of new technologies.

The Commission plans to prepare a Communication on TP by the end of 2003.

6.1 CRITERIA FOR ESTABLISHMENT

Although a flexible and adaptable concept, TPs will not be an appropriate mechanism in every sector of the economy and alternative pathways and solutions should always be investigated. For the credibility of the concept, the setting up of TPs should be limited, in the first instance, to areas for which clear and significant benefits can be established.

The driving forces for initiating a TP will vary according to the challenge to be addressed and the characteristics of the existing situation in the sector concerned. Even though traditional, established sectors (e.g. aero, rail, steel) will have very different characteristics and needs compared to new or emerging sectors (e.g. hydrogen, photovoltaics, plant genomics, several fields related to nanotechnology), the common thread should always be the potential strategic importance of the sector (in terms of major economic, technological or societal challenges), the EU dimension and the importance of the role of RTD in fully achieving the potential benefits.

The main **drivers** likely to point towards potential candidates for a TP include:

– the need to maintain (or regain) world leadership and enhance competitiveness in the face of stiff global competition through the generation of new RTD (e.g. several fields of information and communication technology, aero, steel);

– the need to develop and assimilate new scientific knowledge and technologies to evolve towards a paradigm shift (e.g. rail);

– the need to reconcile different policy objectives with a view to a sustainable development of the sector;

– the need to renew, revive or restructure ailing industry sectors;

– the need to support development of new technology based public goods or services with high entry barriers, uncertain profitability, but high economic and social potential (e.g. medicines for paediatric or poverty-related diseases);

– the opportunity to fulfil the potential of new technologies which hold the promise of radical change in a sector, if developed and deployed appropriately and in time. Global competition may condition, accelerate or decelerate development and deployment and will ultimately translate into a struggle for huge (global as well

as local) markets, with consequences for the economy, employment and social welfare (e.g. new applications of information and communication technology).

Aspects that need to be taken into account in the establishment of selection **criteria** are :

– the identification of a major economic, technological or societal challenge and the pivotal role that RTD can play in addressing that challenge;

– the need for the mobilisation and rapprochement of stakeholders to accelerate progress and optimise the efficient use of resources – particularly where relevant knowledge and activities are fragmented between different MSs and regions; in this respect it should be shown that existing instruments and structures are not capable of achieving the desired outcome;

– the current and projected levels of effort, especially in terms of R&D spending, in relation to the magnitude of the potential socio-economic benefits and the degree of disconnection between the stakeholders, which could benefit considerably from being brought together around a common vision;

– the maturity of the technology or the sector in question;

– the commitment of key players to contribute to the funding of the platform and become actively involved in its development and the execution of its action plan; an initiative coming from a particular sector, rather than from the Commission, could be a good indication of commitment.

6.2 PARTICIPATION IN A TECHNOLOGY PLATFORM

Whilst the precise composition of a TP will vary according to the characteristics of the sector concerned, the principle of mobilising all interested stakeholders in an open and transparent process is paramount. The public-private partnership between the research community, industry and policy makers lies at the heart of a TP, but other actors also need to be drawn into the process for optimal success.

Participation in a TP may include, as appropriate:

– the **research community** – both public and private;

– **industry (including SMEs)** – embracing the whole production and supply chain (including component, equipment and sub-system suppliers and user industries); actors involved in technology transfer and the commercial deployment of technologies could also be involved;

– **public authorities** – both in their roles of regulators and policy makers and promoters and consumers of technologies; although policy measures and related initiatives, given their strategic global dimension, may be launched at the EU level, it is obvious that the national, regional and local levels will have to be associated when they are important initiators of policy and will bear the impact of any policy measures taken by the higher level administrations;

– the **financial community** – banks, including the EIB and EIF, venture capital, insurance etc.;

– **users** and **consumers** – involving the customer base is crucial to channel the process and optimise the benefits of a TP. Products without markets are a waste of resources at all levels;

– **civil society** organisations and NGOs – to ensure that public awareness and understanding of the technologies and challenges do not lag behind developments and act as a barrier to success.

7. Supply chain of human resources for R&D

Ensuring the growth of human resources for R&D that is needed to realise the Barcelona objective requires a coherent range of measures that involve research policies as well as other policies, in particular education, employment, immigration, enterprise.

Taking a systemic approach, the various actions should aim at attracting more pupils to S&T studies, encouraging those who are in the supply chain to move to the next stage, attracting more foreigners and reducing exits at different stages.

Particular attention needs to be given to the following aspects:

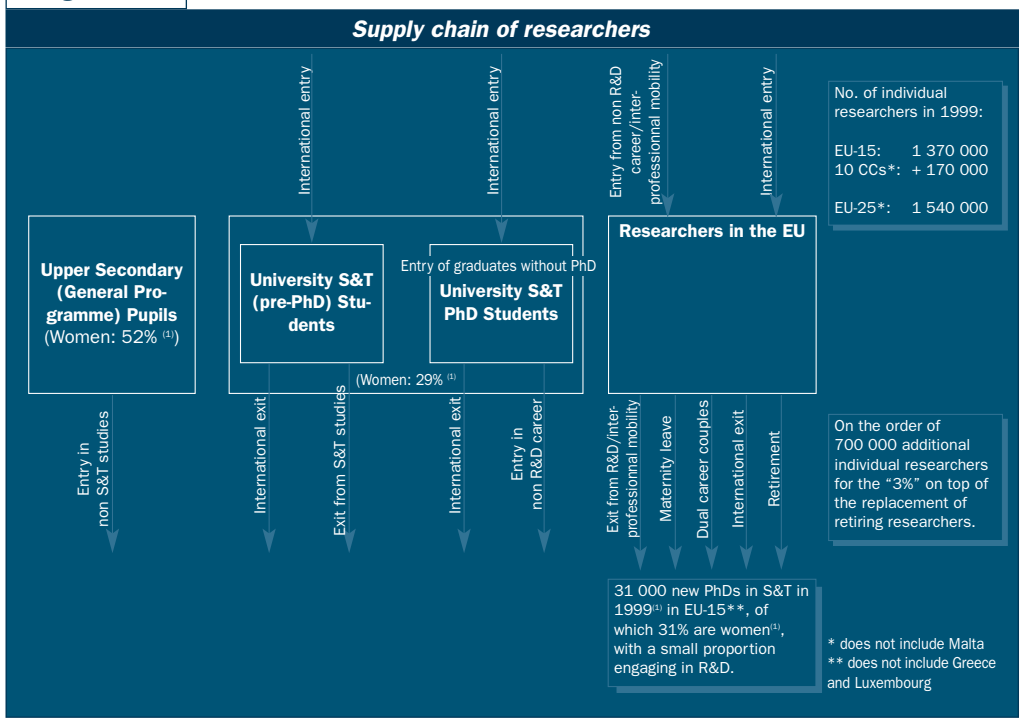
– take into account the lead times involved and therefore the need for both actions with short-term and medium/long-term effects;

– attract and retain more women as they represent the biggest untapped potential of scientists and researchers;

– make optimal use of the high quality and large pool of scientists in Acceding Countries while avoiding a brain drain;

– attract foreign S&T students and PhDs and encourage native EU S&T students and PhDs to return to Europe.

Figure 7.1



Sources:
(1) Eurostat (2003) *Joint Unesco-OECD-Eurostat (UOE) data collection questionnaires.*
(2) Rees, T. (Ed.) (2002) *National Policies on Women and Science in Europe.* European Commission (OPOCE Ref. KI-NA-20-308-EN-C).
(3) Rübsamen-Waigmann, H., et al. (2003) *Women in Industrial Research: A Wake Up Call for European Industry.* STRATA ETAN, European Commission (OPOCE Ref. KI-46-02-759-EN-C).

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The action plan comprises four main sets of actions to increase the level of investment in research in the European Union to 3% of GDP, with two-thirds financed by the private sector:

- **supporting the steps taken by European countries and stakeholders and ensuring that they are mutually consistent and that they form an effective mix of public policy measures;**

- **improving the public support for research and technological innovation;**

- **addressing the necessary increase in the levels of public funding for research;**

- **improving the environment of research and technological innovation in Europe.**

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