Open Method of Coordination (OMC)

3% Action Plan

Report of the CREST expert group on

Public research spending and Policy mixes

Final Report – first cycle

June 2004

Final Report submitted to CREST

Contents

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Executive Summary

In response to the setting of the 3% Barcelona target for R&D investment as a percentage of GDP in the EU and the Commission's subsequent Action Plan to stimulate this investment, an Expert Group on Public Research Spending and Policy

Mixes was charged with stimulating the implementation of a small sub-set of the Action Lines contained in the Action Plan via a process of mutual learning and encouragement to action at national and EU levels.

The Action Lines of interest to the Expert Group focused on:

- The design and fine-tuning of broad policy mixes capable of stimulating investment in R&D;
- The refocusing of public spending on knowledge-related activities, notably research and innovation;
- The public budget requirements for attaining the 3% objective and the repartition of roles between national and EU level;
- The redirection of State Aid towards R&D.

Operating within the context of the first cycle of the Open Method of Coordination (OMC), the Expert Group met on six occasions to share experiences, discuss potential actions and recommend particular policy options to the EU's Scientific and Technical Research Committee (CREST).

The most obvious benefit to be gained from the initiative was the amount of mutual learning that occurred via the sharing of concepts and experiences. Developments in the design and operation of broad policy mixes were identified and shared and efforts made to identify good practices. The complexity of the subject matter, however, means that mutual learning (primarily via the peer review of policy mixes in different countries) should continue to be the dominant feature of activities in this area in the second cycle of the OMC, accompanied by more focused efforts to identify good practices, evolve guidelines and ensure the adequate development of suitable indicators of progress.

The main recommendations of the Expert Group addressed to CREST are given below for each Action Line:

Designing and Fine-tuning Policy Mixes

Data Collection and Analysis

Recommendation 1

To avoid overlaps, improve co-ordination and minimise the burden on national administrations, the Expert Group strongly recommends that CREST invites DG Research and DG JRC-IPTS to work with DG Enterprise and other relevant bodies to rationalise the collection and analysis of data on R&D and innovation. Future initiatives in this area should aim to minimise the burden on the providers of information by avoiding duplication, but maximise the utility of the outputs by providing a variety of analyses and outputs tailored to the needs of different 'customers'. One possibility strongly favoured by the Expert Group is to supplement DG Enterprise's TrendChart via the collection and analysis of research and research policy-related data relevant to the attainment of the 3% Barcelona target. The feasibility of expanding this to cover all indicators and policy developments relevant to the task of making the EU the most competitive and dynamic knowledge-based economy in the world should also be examined.

National Reports

Recommendation 2

When preparing 'National Reports on R&D and Innovation', Member States can benefit from an examination of the form and content of best practice examples in the area. In order to improve comparability and collective learning, however, there is scope for CREST to suggest that work commences on the development of a 'best practice' template for such reports, elements of which Member States can adopt during their preparation. This template should contain a list of necessary data requirements if countries are to monitor progress towards policy objectives (e.g. R&D targets) in an adequate and appropriate fashion.

Monitoring and Evaluation

Recommendation 3

The Expert Group invites CREST to support the development of appropriate methodologies for the monitoring and evaluation of national policy mixes, with a view to their subsequent trial use in volunteer countries. If successful, these trials could lead to the development of guidelines that Member States could use within the context of 'experiment and evaluate' approaches to the design and implementation of appropriate policy mixes.

Peer Reviews

Recommendation 4

Peer reviews have great potential as mutual learning platforms, but they can take many forms, all with very different resource implications. The Expert Group thus asks CREST to support an appraisal of the use of peer reviews within the context of the Open Method of Coordination (OMC). During this appraisal, the OECD should be consulted over both the potential form of the reviews and the possibility of conducting joint exercises. The resources required to undertake such reviews should also be appraised. CREST should also invite Member States to volunteer for trial peer reviews of their policy mixes in the next cycle of the OMC, and to feed back assessments of these exercise into the design of future initiatives in subsequent cycles of the OMC.

Governance and Coherence in the Design of Policy Mixes

Recommendation 5

Systems of governance within Member States are a function of political, legal and bureaucratic traditions, and the communication and coordination structures and processes relevant to the design of coherent policy mixes vary accordingly from one setting to another. A number of countries have attempted to improve the coherence of policy mixes via the introduction of new governance structures. CREST should invite interested countries to review the effectiveness of their own governance structures and processes with a view to improving the formulation of coherent research and innovation policy mixes.

Refocusing Public Spend

Recommendation 6

The Expert Group asks CREST to invite Member States to provide relevant material on innovative approaches to the refocusing of public spend on knowledge-related activities (KRA) and the raising of funds for R&D. It also asks CREST and the Commission to support the preparation of a document containing exemplars and guidelines for Member States seeking to raise funds for the refocusing of public spend on KRA in general and R&D in particular.

Recommendation 7

Internationally acceptable definitions of KRA are needed in order to track and compare efforts to refocus public spend. Given the complexity of the subject, the Expert Group considers that the elaboration of such definitions and associated indicators is a matter for specialists in the field. It therefore asks CREST to consider how developments in this area might best be taken forward via a process of consultation and negotiation between the Commission (including Eurostat), the OECD and national statistical offices. An important consideration during these discussions should be the need to minimise the burden on national administrations wherever possible via the use of existing data and indicators.

Public Budget Needs

Recommendation 8

CREST should invite the Commission to prepare simulations and share information on the ways in which potential increases in EU R&D and innovation budgets and structural funds might contribute to the attainment of the Barcelona targets and impact on Member States' public budget requirements. There is also scope for a review of the processes and techniques used by Member States to assess public R&D budget needs. CREST should therefore invite the Commission and Member States to conduct such a review and support the development of improved processes and tools, with a view to discussing their utility at future workshops.

Recommendation 9

Increases in both the EU R&D budget and the R&D budgets of Member States are likely if the overall target of 3% of GDP for the EU as a whole is to be met. CREST should thus advise Member States that increases in Community funding should not be offset by reductions in the relevant national budgets, since participation in national programmes often underpins success in the competition for Framework funding. Concerning Structural Funds, CREST should also remind Member States of the importance of dedicating an increasing share of these funds to the development of appropriate R&D infrastructures and related R&D activities.

Redirecting State Aid

Recommendation 10

CREST should invite interested Member States with successful track records in the redirection of State Aid to horizontal activities in general, and to R&D in particular, to prepare material indicating why and how this was accomplished, with a view to the production of a guide for the use of other Member States.

1 Introduction

Within the framework of Europe's ambition to become the most competitive and dynamic knowledge-based economy in the world, the European Council called for an increase in European R&D investment levels. New targets established at the 2002 Council meeting in Barcelona called for these levels to rise from 1.9% to 3% of GDP by 2010, with two-thirds financed by the private sector and the remainder by public bodies. In response, and after widespread consultation, the European Commission launched an Action Plan designed to close the R&D gap between Europe and its global competitors.

The Commission Communication 'Investing in Research: An Action Plan for Europe' set out the type of actions needed to increase the level of R&D investment in Europe. These fell into four main categories:

- Actions aimed at developing a common understanding amongst all R&D and innovation stakeholders of the importance of sustained and coherent efforts to attain the R&D investment targets;
- Actions aimed at improving the effectiveness of public support for research and innovation;
- Actions aimed at redirecting public resources towards research and innovation;
- Actions aimed at improving the framework conditions for research and innovation.

Spread across these categories, one particular group of actions was concerned with the overall mix of policies employed by countries to raise R&D intensity levels. Specifically, these actions were meant to:

- Improve the effectiveness of public actions to promote R&D by:
  - Encouraging the design of policy mixes capable of deploying a variety of policy instruments in a coherent way;
  - Nurturing interactions between the policies implemented by different countries and by the European Union as a whole, notably through the open method of co-ordination;
- Optimise or fine-tune the mix of financing instruments within national policy mixes, taking into account the needs of different industry segments and R&D-related developments at a European level and in other countries;
- Encourage and monitor the refocusing of public spending towards knowledge-related activities, notably research and innovation;
- Analyse and discuss with Member States and acceding countries[1]:
  - The public budget requirements for attaining the 3% objective;
  - The repartition of roles and efforts between national and Community levels in the period up to 2010;
- Redirect State Aid towards R&D as part of the more general redirection of State Aid towards horizontal objectives.

[1] Henceforth in this report, all countries represented at CREST meetings will be referred to as Member States.

Subsequently, an Expert Group on Public Research Spending and Policy Mixes was charged with stimulating the implementation of these Action Lines via a process of mutual learning and encouragement to action at national and EU levels.

The Expert Group met on six occasions over the period from November 2003 to June 2004. The main working methods involved the collection of relevant information by national representatives; presentations by participating countries and invited experts on policy practices across Europe and the rest of the world; discussion of key issues within the context of Expert Group meetings; and the preparation of a series of deliverables to the EU's Scientific and Technical Research Committee (CREST), all within the framework of an annual reporting cycle. Whenever relevant, the Expert Group coordinated its activities with those of the four other Expert Groups set up to further the progress of the 3% initiative, and the Group received invaluable support in the collection and analysis of data relevant to the Group's objectives from the Institute for Prospective Technological Studies (IPTS) in Seville, part of the EU's Joint Research Centre.

For each of the Action Lines, the Group considered the feasibility of six potential tasks and associated deliverables:

- A review of the main developments in participating countries, with the potential to be updated annually;
- The identification of good or novel practices and potential obstacles to progress;
- The identification of appropriate indicators for measuring progress, assessing impact and setting targets at EU and national levels;
- Contributions to the development of joint/concerted actions among several participating countries;
- Contributions to the development of EU guidelines;
- Identification of the need for other initiatives at Community or national level.

Exhibit 1 shows the Expert Group's coverage of the different tasks within the first cycle of the exercise (i.e. before June 2004).

The Expert Group's first task was to review the main developments relevant to each Action Line. A questionnaire with a strong emphasis on the monitoring of broad policy developments was devised and circulated to CREST representatives for completion. Twenty-six countries[2] responded and, aided by the analytical efforts of DG JRC-IPTS and the sharing of information between countries, the Group was then able to review and discuss patterns and trends in Europe and identify good or novel practices.

[2] Austria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the UK.

Exhibit 1 – Feasibility of Different Options in the First Cycle

		Action Lines			
		Design and Fine-tune Policy Mix	Refocus Public Spend	Public Budget Needs	Redirect State Aid
Tasks	Review Developments				
	Identify Good Practices/Obstacles				
	Identify Indicators				
	Develop Joint Actions				
	Develop EU Guidelines				
	Identify Other Initiatives				

Feasibility Key 

In parallel with this data collection exercise, and in keeping with the aim of enhancing mutual learning, individual members of the Expert Group also gave presentations on policy practices within their own national and regional settings and heard comparisons of policy practices around the world from external experts.[3] These stimulated debate and the exchange of information on particular instruments, processes and issues, which further facilitated the identification of effective policy mixes, good practices and potential obstacles to progress.

On the basis of these analyses and discussions, the Expert Group was then able to formulate a series of recommendations aimed at CREST. These focused on actions that could be ratified and initiated within the first cycle of the process, and on actions more suitable for implementation in subsequent cycles.

[3] Belgium (with a focus on the Flanders region), Finland, Germany, Spain, France, Hungary, Ireland, the Netherlands and the UK, plus two overviews of related OECD exercises from Jerry Sheehan (OECD) and John Barber (UK).

2 Results

The results of the Expert Group's deliberations are presented in five sub-sections. The first of these, which is largely descriptive in nature, reviews salient aspects of the various policy contexts in which policies capable of raising R&D investment levels are being deployed. The second addresses the first two Action Lines mentioned in the introduction, namely the design and fine-tuning of policy mixes, while subsequent sub-sections deal with the remaining three Action Lines.

2.1 Policy Contexts

The drivers of R&D and innovation policy developments vary across Europe. In many countries R&D policies are put in place to effect downstream improvements in economic performance, competitiveness and social welfare, implicitly acknowledging the links with R&D intensity. Efforts driven by the perceived need to improve national innovation systems and make progress towards knowledge-based societies also acknowledge these relationships. In some countries, specific strengths, weaknesses, opportunities and threats constitute the rationale for sets of R&D innovation strategies designed variously to improve public research bases, promote public-private linkages, attract foreign investment or stimulate the provision of venture capital.

The 3% target set at Barcelona for the EU as a whole has had a significant impact on policies designed to raise R&D intensity levels. Only three Member States[4] had achieved R&D investment levels greater than 3% of GDP. Since Barcelona, however, a significant number of countries have formally incorporated the 3% target into their policy frameworks, while many others have set more realistic R&D targets – given their circumstances – and have implemented, or plan to implement, specific measures to achieve them. Only two of the 26 countries responding to the survey have no current plans to set specific R&D investment targets, though both have R&D and innovation policy portfolios in place which are likely to effect increases in R&D intensity in the future.

While most countries have specific measures aimed at raising R&D investment levels, the majority of these instruments are implemented within the context of broader portfolios. Most of these policy mixes are either geared towards improving the performance of national (and regional) innovation systems, or have been specifically formulated within the context of national multi-annual development plans.

Instruments tackling human resource constraints on the attainment of the 3% target are an integral part of many policy portfolios. Many of these measures focus on efforts to improve the supply of S&T postgraduates and the quality of higher education generally – with some targeted at raising recruitment in specific technology areas – while others are designed to make research careers more attractive and to stimulate researcher mobility, particularly within the public sector. Far fewer measures attempt to stimulate the demand for S&T graduates or researchers within the private sector.

[4] Finland, Israel and Sweden

The use of conventionally accepted indicators of research inputs (financial and human resources) and related outputs (publications, patents, trade statistics) to track progress towards the attainment of R&D policy goals is widespread. There are also signs, however, of an increased emphasis on new sets of indicators designed to capture a greater range of innovation system developments.

The attainment of R&D investment targets is dependent on a range of factors and is by no means certain. One factor perceived to be important by many countries is the strength of the public research base and its ability to absorb additional investment and perform quality R&D. In a similar vein, some countries see the strength of select indigenous industrial sectors as a positive influence. Other factors likely to facilitate progress towards the 3% target include the strong commitment of government, a stable macroeconomic framework and, for the new Member States, greater access to the resources of the EU as a whole. Overall, however, recognition of these factors as positive influences on goal attainment is not widespread.

In contrast, recognition of the potential of some factors to have very negative impacts on the attainment of the 3% target is common. Most pervasive are funding limitations (especially public funding constraints), human resource constraints, infrastructural deficiencies and a set of factors reflecting the existence of a risk averse culture in Europe and low public appreciation of the critical role of innovation and creativity in socio-economic development.

2.2 Actions 1 and 2 – Designing and Fine-tuning Policy Mixes

- Improve the effectiveness of public actions to promote R&D by:
  - Encouraging the design of policy mixes capable of deploying a variety of policy instruments in a coherent way;
  - Nurturing interactions between the policies implemented by different countries and by the European Union as a whole, notably through the open method of co-ordination;
- Optimise the mix of financing instruments within national policy mixes, taking into account the needs of different industry segments and R&D-related developments at a European level and in other countries.

2.2.1 Patterns, Trends and Key Issues

Many combinations of policies and policy instruments (i.e. 'policy mixes') can potentially impact, directly or indirectly, on R&D investment levels. Such measures include R&D grant and tax incentive schemes, but can also include measures such as access to venture capital for high tech SMEs and changes to framework conditions such as those brought about by modifications to competition policy.

The precise combination of policies or policy mixes in place in individual countries and the range of ministries involved in their formulation and deployment varies across the EU in line with local needs, historical practices and systems of governance. Perceptions of the combinations of instruments likely to affect R&D investment levels

also varies within countries, as the institutional settings of observers can colour perspectives. Representatives of science ministries, for example, often depict policy mixes in terms of 'classical' science policy instruments, while those from economic and finance ministries respectively place greater stress on the role played by 'innovation policy' instruments and broader policies affecting framework conditions. Strict comparisons across countries of relevant policy mixes are also hindered by the lack of a shared understanding of many of the concepts involved in analysing, formulating, managing, assessing and improving policy mixes, and **greater efforts are needed to develop a mutual appreciation both within and between countries of many of the concepts and practices underpinning the deployment of effective policy mixes**.

Notwithstanding the difficulties involved in comparing policy mixes across countries, it is still possible to make some tentative observations about the composition and evolution of these policy mixes and their potential impact on private sector R&D investment levels. Concerning the former:

- Although some countries have similar policy mixes, the differences between countries are generally greater than the similarities;
- Policy shifts over time have occurred in many countries, though generally these have been country specific or limited to a handful of countries and have not represented common trends across all countries. Examples of such shifts include:
  - A greater emphasis on science-industry links and collaboration and less support for single firms;
  - More emphasis on infrastructural reform in the public R&D sector;
  - A greater emphasis on improving framework conditions;
  - Alterations in the balance of direct and indirect measures;
  - Shifts in some countries towards support for mission-oriented R&D and technology transfer;
  - Shifts in other countries towards greater support for more fundamental R&D;
  - More attention to issues of governance and the efficiency and effectiveness of government support.

Concerning the potential impact of policy mixes on private sector R&D intensity, the following cautious generalisations can be made:

- Policies affecting framework conditions are expected to have a significant impact on R&D intensity levels, though not as great as direct and indirect R&D and innovation measures;
- Only a small number of countries expect the impacts of framework conditions to be more significant than those of R&D and innovation measures, though these countries generally possess a more sophisticated appreciation of the concepts underpinning the formulation of holistic policy mixes;
- Direct measures are expected in most countries to have a greater impact than indirect fiscal measures;
- Policies are expected to influence levels via many routes, especially via the creation of high-tech SMEs, hikes in the capacity of existing R&D actors and improvements in the R&D infrastructure;

- Infrastructural improvements are less important in EU-15 countries than they are in other countries;[5]
- EU-15 countries expect a smaller range of instruments to have impacts on R&D intensity than other countries;
- EU-15 countries expect the range of impacts to be less diverse than the ranges expected in other countries;
- Most policy mixes emphasise grants for R&D, collaborative R&D and networking, information and brokerage schemes, schemes to strengthen public research and schemes to relieve human resource bottlenecks.

In most countries, the structure and composition of the policy mixes in place are the outcome of relatively autonomous policy formulation processes in all the various science, economic and finance ministries responsible for implementing policies with the potential to affect R&D investment levels. Not unnaturally, there are often tensions between the policies and policy objectives of different government departments, and a corresponding need for mechanisms to ensure that the components of a policy mix are in alignment with each other. Frequently these take the form of inter-departmental or inter-ministerial committees meeting on a regular basis to agree common lines. On other occasions, more *ad hoc* arrangements are put in place to review complementarities and formulate joint strategies.

There is some evidence that co-ordination between individual policies and policy instruments could be improved. Factors with a negative influence on the formulation and composition of appropriate and effective policy mixes include budgetary constraints and, in some countries, weak co-ordination between the various ministries and authorities responsible for developing the component parts of policy portfolios.[6] In these cases, **there is scope for greater coordination in the design of appropriate and effective policy mixes**.

Factors with a widespread positive influence on policy development include the efforts of the EU to share experiences and best practices across countries, and the strength of central and regional government commitment to the prioritisation of R&D and innovation policy. **Some of the countries noting government commitment as a positive influence, however, also cited lack of co-ordination between ministries as a negative influence**. Without steps to improve co-ordination, the rhetoric of commitment is unlikely to be translated into the reality of effective policy mixes.

Lack of familiarity with policy mix concepts and the structures needed to evolve appropriate mixes is reflected in the dearth of mechanisms available to monitor and evaluate the operation and performance of national systems of innovation and associated support policies, though this is also a function of the difficulties involved in the elaboration of appropriate assessment regimes. **Whereas many countries now have systems in place to monitor and assess individual policy mechanisms, few**

[5] Information about national R&D and innovation systems were collected and analysed prior to May 1st, hence the reference to the EU-15 countries.

[6] Although there is obviously communication between finance and all other ministries concerning budgets, the coordinated evolution of complementary policies between most ministries with the potential to affect R&D investment levels is less frequent.

have the capability to perform assessments of the policy mix as a whole – though there is evidence of an increasing interest in ways of conducting such reviews and of benefiting from international comparisons. Policy practices in other countries are often monitored, but there have been few systematic efforts to date to review, compare and contrast the performance of national policy mixes. In many countries, however, there is a growing appreciation of the need for more 'policy intelligence' in the design of R&D and innovation-related policies and policy portfolios.

2.2.2 Good Practices

The nature, complexity and contextual dependence of national and regional innovation systems all imply that there is no theoretically optimal policy mix for any one system, and no criteria capable of determining whether any particular policy mix can be said to be 'best practice' when compared with the policy mixes of other countries. Of course many policy mixes can be fine-tuned and improved, and a number of Member States have engaged over the past year or two in major policy reviews (e.g. DE, NL, UK). From these it is often possible on the basis of experience and comparison to identify both ways in which to improve individual policies and 'good practice' in the formulation of appropriate policy mixes – especially in terms of the practices used to collect, analyse, prepare and share information and knowledge relevant to the design of appropriate policy mixes.

On an international level, there are many examples of good practice in terms of data collection and analysis. OECD has for many years undertaken work of great value to national governments, and within the Commission the work undertaken in preparation for the publication of the first, second and third European Reports on Science and Technology Indicators deserves to be mentioned. The relatively recent European Innovation Scoreboard and the TrendChart initiative have also become valuable sources of comparative data on both innovation activities and associated policies.

There are also many good examples of data collection and analysis at a national level and the subsequent presentation of pertinent material within the context of national reports, either on a regular or an *ad hoc* basis. The German national report on R&D activities is published every two years and is one of the exemplars other countries could follow when preparing similar material. The recent reviews conducted by the UK and Netherlands governments of innovation-related activities and policies provide models for such reviews, as do the processes adopted in Ireland during the preparation of the Irish response to the 3% Action Plan. **An important point to note about all these exercises in policy analysis and design is their common *leitmotif*, namely their preoccupation with policy prescriptions designed to improve innovation system performance as a whole, and not with prescriptions designed solely to raise R&D expenditure levels to a fixed percentage of GDP** (though such increases are envisaged as one of the main consequences of adopting successful policy mixes). Many of the policy formulation and planning procedures implicit in the preparation of National Development Plans by countries currently or formerly in receipt of Structural Funds are also worthy of consideration by other nations.

There are, nowadays, many examples of good practice across Europe in the design and implementation of monitoring and evaluation systems in the fields of R&D and innovation. Countries historically in the vanguard in these areas (the

Scandinavian countries and the UK in particular) have now been joined by many others (e.g. Germany, the Netherlands, Ireland and Austria, to name but a few), and systems and practices within the European Commission have also improved considerably over the last decade.

In all settings, however, the emphasis has traditionally been on the monitoring and evaluation of single instruments rather than on portfolios of related programmes or the policy mix as a whole. There is a discernible trend, however, towards the evaluation of bundles of related programmes. In addition to the aggregated assessments of specific RTD programmes within the context of the EU Framework Programmes and the one-off innovation reviews conducted by the UK and Netherlands, the UK has commissioned an evaluation of all its support for biotechnology. There has also been a systematic attempt by TEKES in Finland to shift from the monitoring and evaluation of single instruments to portfolio evaluations and, latterly, thematic evaluations such as evaluations of the role of multiple technology programmes in the evolution of particular industrial sectors. **No countries yet, however, have attempted evaluations of the impact of holistic policy mixes on innovation system performance, though OECD is currently contemplating work in this arena**. Given the current state of the art in the field, this is a challenging, though hopefully achievable, goal.

In terms of sharing and mutual learning, peer review exercises constitute one way in which information and experience of a particular topic can be transmitted and absorbed by interested parties, and again one can turn to the OECD for an example of good practice. In a recent exercise, public-private partnerships were the focus of a peer review 'campaign' which took the form of:

- The preparation of a background document on the topic;
- The distribution of a questionnaire to Member States;
- The preparation by OECD of a framework document based on the response to the questionnaire and the identification of interesting topics for further investigation;
- The preparation of national reports on these topics by Member States;
- OECD missions to each country to discuss these topics with key stakeholders;
- The preparation by OECD of a synthesis report containing facts, interpretations and suggestions for each country participating in the peer review;
- The presentation and discussion of all national reports at a general meeting (i.e. the actual peer review), with each country presenting their own reviews and nominated countries commenting upon them;
- The revision of the national reports by each country and their subsequent publication.

Within individual countries, the ability to evolve effective policy mixes is greatly enhanced if the procedures in place to gather and analyse relevant data are complemented by effective communication and coordination between all the ministries with a potential role to play in the evolution of appropriate policy mixes. In the UK, there is little doubt that collaboration between the Treasury and the Department of Trade and Industry was critical to the development of complementary grant and tax measures to stimulate R&D. Similarly, the constitution of a high-level

Innovation Council in Finland involving the Head of State has stimulated considerable interest in this type of mechanism in other countries.

2.2.3 Recommendations

Most of the recommendations concerning the design of effective policy mixes are aimed at developing a shared understanding of the concepts and practices that form the basis of sound policy development within complex research and innovation systems. One is aimed at the evolution of appropriate governance structures.

Data Collection and Analysis

The development of a shared conceptual understanding across EU countries and regions would be greatly facilitated by the collection of comparable data covering a broad range of indicators describing research and innovation system developments. Currently much useful information on innovation-related indicators and policy developments is collected and analysed within the TrendChart initiative of DG Enterprise, whereas DG Research focuses on research and research policy-related data. DG JRC-IPTS also collects and analyses much useful information via its European Science and Technology Observatory (ESTO) and its planned ERAWATCH and European Techno-Economic Policy Support (ETEPS) networks.

To avoid overlaps, improve co-ordination and minimise the burden on national administrations, the Expert Group strongly recommends that CREST invites DG Research and DG JRC-IPTS to work with DG Enterprise and other relevant bodies to rationalise the collection and analysis of data on R&D and innovation. Future initiatives in this area should aim to minimise the burden on the providers of information by avoiding duplication, but maximise the utility of the outputs by providing a variety of analyses and outputs tailored to the needs of different 'customers'. One possibility strongly favoured by the Expert Group is to supplement DG Enterprise's TrendChart via the collection and analysis of research and research policy-related data relevant to the attainment of the 3% Barcelona target. The feasibility of expanding this to cover all indicators and policy developments relevant to the task of making the EU the most competitive and dynamic knowledge-based economy in the world should also be examined.

National Reports

Data collection on research and innovation-related activities at a national level varies considerably across the EU. Many countries publish R&D data on an annual or bi-annual basis. Other countries produce comprehensive, though less frequent, reports covering much of the terrain relevant to the functioning of national research and innovation systems. Decisions to conduct very detailed and focused exercises are taken on a sporadic, 'as needed' basis. Given the vast contextual differences that exist between countries and the different political pressures governing the timing of these exercises, there is little merit in advocating the wholesale adoption of a rigid set of data collection processes and homogenous presentation practices. There is merit, however, in learning from the experiences of others. Some degree of uniformity in the preparation of nationally published R&D and innovation-related expenditures would also facilitate sharing and improve comparability.

When preparing 'National Reports on R&D and Innovation', Member States can benefit from an examination of the form and content of best practice examples in

the area. In order to improve comparability and collective learning, however, there is scope for CREST to suggest that work commences on the development of a 'best practice' template for such reports, elements of which Member States can adopt during their preparation. This template should contain a list of necessary data requirements if countries are to monitor progress towards policy objectives (e.g. R&D targets) in an adequate and appropriate fashion.

Monitoring and Evaluation

The importance of monitoring and evaluating the performance of R&D and innovation policy instruments has become increasingly recognised, with many Member States implementing schemes to assess the efficiency and effectiveness of single instruments. Few schemes exist, however, to assess the performance of whole policy portfolios, though commendable reviews of national innovation systems have been undertaken in a limited number of countries. If policy mixes are to be improved and fine-tuned, experimentation with new combinations of instruments has to take place within the context of monitoring and evaluation schemes capable of detecting and assessing improvements in overall R&D and innovation system performance.

The Expert Group invites CREST to support the development of appropriate methodologies for the monitoring and evaluation of national policy mixes, with a view to their subsequent trial use in volunteer countries. If successful, these trials could lead to the development of guidelines that Member States could use within the context of 'experiment and evaluate' approaches to the design and implementation of appropriate policy mixes.

Peer Reviews

Involvement in national monitoring and evaluation schemes, data collection exercises and the preparation of innovation system reviews and annual reports can greatly enhance national capabilities in the design of effective policy mixes. So too can access to the results of similar exercises in other countries. Mutual learning between the policymaking circles of different countries is more effective, however, when simple dissemination strategies are complemented by approaches that place a greater stress on interaction between countries. International peer review exercises in which the representatives of different countries comment upon the policy mixes of other countries and compare them with their own are examples of such approaches. For the countries being reviewed, there is an opportunity to benefit from the breadth of experience in other countries, while for the reviewers there is an equally valuable opportunity to look in detail at the functioning of other innovation systems and the arguments underpinning the policy mixes in place.

Peer reviews have great potential as mutual learning platforms, but they can take many forms, all with very different resource implications. The Expert Group thus asks CREST to support an appraisal of the use of peer reviews within the context of the Open Method of Coordination (OMC). During this appraisal, the OECD should be consulted over both the potential form of the reviews and the possibility of conducting joint exercises. The resources required to undertake such reviews should also be appraised. CREST should also invite Member States to volunteer for trial peer reviews of their policy mixes in the next cycle of the OMC, and to feed back assessments of these exercise into the design of future initiatives in subsequent cycles of the OMC.

Governance and Coherence in the Design of Policy Mixes
The governance structures within which countries formulate and implement policies to regulate R&D and innovation-related activities are context dependent and historically determined. Recommendations concerning the adoption of particular modes of governance or sets of practices should not therefore be made lightly. In terms of the formulation of comprehensive policy mixes, however, the perceived lack of adequate communication and coordination between ministries in some national governance structures and the resultant lack of coherence between policies does merit concern.

Systems of governance within Member States are a function of political, legal and bureaucratic traditions, and the communication and coordination structures and processes relevant to the design of coherent policy mixes vary accordingly from one setting to another. A number of countries have attempted to improve the coherence of policy mixes via the introduction of new governance structures. CREST should invite interested countries to review the effectiveness of their own governance structures and processes with a view to improving the formulation of coherent research and innovation policy mixes.

2.3 Action 3 – Refocusing Public Spend

- Encourage and monitor the refocusing of public spending towards knowledge-related activities, notably research and innovation.

2.3.1 Patterns, Trends and Key Issues

Efforts to increase R&D intensity within the EU and to promote the development of an information or knowledge society will inevitably involve the refocusing of public spending on research, innovation and other knowledge-related activities (KRA) such as education and training. Few countries, however, have explicitly set out to address either the balance between KRA and non-KRA in their overall policy mix, or to effect a balance between R&D, innovation and educational activities based on a comprehensive appraisal of relative needs in these areas. The inclusion of KRA among the national priorities for development is nevertheless widespread, as is a commitment to raise public expenditure on R&D over the coming years, though targets vary considerably from one context to another.[7] Most countries are also contemplating or implementing a whole range of direct and indirect R&D and innovation support measures that are likely to alter the balance between KRA and non-KRA activities. Special funds dedicated to KRA have been set up in select countries, and a handful of countries are experimenting with innovative ways of raising funds to support new KRA initiatives. Implicitly, therefore, the balance between KRA and non-KRA is likely to tip towards KRA, though there is little doubt that this shift would benefit from the sharing of mutual experiences and lessons learnt.

[7] Although there is a 3% target for the EU as a whole, individual countries are expected to set targets appropriate to their own circumstances. For the overall EU target to be attained, however, most of the larger R&D spenders will have to attain or surpass this level of expenditure.

The refocusing of public spending on research, innovation and other knowledge-related activities would by facilitated by an accounting framework which Member States could use to assess whether or not they are successfully reallocating resources from non-KRA to an appropriate range of KRA. Such a framework would also allow them to reallocate resources from one KRA to another. Moreover, if benchmarking is to play a part in the successful realignment of policies across the EU, there needs to be an internationally acceptable accounting framework for such activities.

Unfortunately, the refocusing of public spend towards KRA is currently hindered by the lack of a commonly accepted framework of definitions. Most countries loosely define KRA in terms of R&D, innovation, primary, secondary and higher education and life-long learning, though some also use categories such as information society activities and knowledge transfer. Well-structured definitions of KRA are difficult to find, however, and definitions across countries are rarely commensurable.

The most positive factors affecting a reorientation to KRA are the strength of government commitment and, often building on a track record of economic growth, the solidification of intent in national plans and new funds, measures, institutions and infrastructures. The EU's pursuit of the Barcelona and Lisbon objectives and the establishment of the ERA and benchmarking activities have also underpinned much of the required refocusing.

In contrast, a number of factors threaten continued efforts to shift the balance towards KRA. The most important are financial, with a number of countries pessimistic about overall macroeconomic prospects. Even more widespread is the view that budget constraints could hinder a commitment to refocusing. In some quarters there is also concern that a limited appreciation of the importance of R&D and innovation amongst the broader populace will affect the political will to increase support for KRA, while some countries with relatively weak scientific infrastructures and few qualified scientific and technological personnel are worried about the rate at which they can absorb or exploit increased levels of funding.

2.3.2 Good Practices

Data on public spending on KRA are potentially available via analysis of departmental budgets across government. Few governments, however, make systematic attempts to identify and account for KRA in this way. In part this is due to the difficulty of defining KRA in a consistent way across government departments. It also owes something to the lack of a perceived need for an accounting framework for KRA, though this perception is beginning to change as awareness of the need to assess progress towards a knowledge-based society becomes stronger.

National definitions and indicators of KRA vary considerably and offer no common base for international comparison, but international frameworks do exist. The OECD, for example, has an indicator of 'Investment in Knowledge' that is based on national spend on R&D, Software and Higher Education. DG Research, too, has produced a composite indicator of investment in the knowledge-based economy, comprised in this instance of various indicators capturing trends in knowledge creation (e.g. R&D expenditure per capita; number of researchers per capita; new S&T PhDs per capita) and knowledge diffusion (expressed in terms of human capital, information infrastructure and new embedded technology indicators). Such indicators, however,

do not distinguish between private and public spend on KRA and are thus of limited use as a framework for reorienting public spending.

Despite the lack of adequate accounting frameworks, the strength of commitment to KRA across the EU is demonstrated by the development of national plans for R&D and innovation (e.g. the Spanish National R&D and Innovation Plan, the Romanian National Plan for R&D and Innovation and the Latvian National Innovation Programme), various policy reviews (e.g. in the UK and the Netherlands) and a wide variety of new support mechanisms. Of particular interest are the dedicated funds created in countries such as Denmark, Norway, Hungary, Ireland, the Netherlands and Slovenia.

Many countries have also found innovative ways of raising funds for KRA. These include specific cutbacks in other budgets (e.g. from the energy sector in Portugal and Lithuania, and from non-KRA related subsidies to industry in Hungary and the UK), and routes that involve increased tax yields as a result of growth or new taxes. In Norway, for example, there is an R&D tax on fish and agricultural products. Norway also raised funds for its dedicated research and innovation fund via the sale of state-owned shares, supplemented subsequently by petroleum revenue. The yield from the capital invested in this fund is now used primarily to strengthen longer-term research. The Netherlands also channelled profits from the exploitation of its gas resources into support for R&D and innovation.

In the UK there is increasing emphasis on the use of public-private partnerships to leverage funding for R&D and innovation, and in the UK, Germany and elsewhere there are a growing number of instruments being developed to improve access to venture capital for SMEs and high-tech start-ups. There are also interesting examples in Spain and France of attempts to leverage private funding through charities and sectoral associations. In Hungary, the savings resulting from efficiency gains in public administration are expected to free up funds for reallocation, and in a small number of countries (e.g. Ireland and Hungary) government efforts to induce foreign multinationals to relocate R&D capability are expected to stimulate greater R&D intensity. Attempts in Spain to step up public technology procurement are also interesting, since the requirement for many items purchased by government through such schemes to have an R&D component is an obvious means of refocusing public spend.

2.3.3 Recommendations

The key need in this area is to find ways of encouraging Member States to refocus public spend on KRA in general and R&D in particular. Many Member States have found interesting ways to refocus public budgets and raise funds for the support of R&D activities, and there are several lessons to be learned from these examples if published material is available on them.

The Expert Group asks CREST to invite Member States to provide relevant material on innovative approaches to the refocusing of public spend on knowledge-related activities (KRA) and the raising of funds for R&D. It also asks CREST and the Commission to support the preparation of a document containing exemplars and guidelines for Member States seeking to raise funds for the refocusing of public spend on KRA in general and R&D in particular.

There is a pressing need in this area for a commonly accepted definition of KRA in the Member States and an internationally accepted set of associated indicators capable of use as an accounting framework for the refocusing of public spend on KRA. There are at least two complementary routes. One involves working with bodies such as the OECD, DG Research and Eurostat to explore both the construction of new definitions, indicators and composite indicators and the possibility of disaggregating public and private spend. The other involves the experimental construction of data sets based on reviews of departmental spend in a select number of pilot countries, though articulation of the necessary definitions would again benefit from consultation with the bodies noted above. The Expert Group also recognises, however, that finding acceptable definitions, indicators and frameworks is not an easy task, since there are valid qualms about the balance to be struck between knowledge creation and knowledge diffusion indicators (or between R&D and innovation indicators) in the construction of composite indicators; about the specific numerators and denominators to be used in the construction of indicators; and genuine debates about the usefulness of composite indicators and the nuisance cost of collecting data on new indicators.

Internationally acceptable definitions of KRA are needed in order to track and compare efforts to refocus public spend. Given the complexity of the subject, the Expert Group considers that the elaboration of such definitions and associated indicators is a matter for specialists in the field. It therefore asks CREST to consider how developments in this area might best be taken forward via a process of consultation and negotiation between the Commission (including Eurostat), the OECD and national statistical offices. An important consideration during these discussions should be the need to minimise the burden on national administrations wherever possible via the use of existing data and indicators.

2.4 Action 4 – Public Budget Needs

- Analyse and discuss with Member States and acceding countries:
  - The public budget requirements for attaining the 3% objective;
  - The repartition of roles and efforts between national and Community levels in the period up to 2010.

2.4.1 Patterns, Trends and Key Issues

The 3% target for aggregate R&D intensity across the EU is based on an understanding that a benchmark figure of 1% of GDP will be spent by the public sector and 2% by industry. Of the 1% spent by the public sector, some will go towards satisfying governments' own R&D needs (including expenditure on 'public good' R&D in universities etc.), and some will attempt to catalyse and leverage increased private sector spend. Similarly, a proportion of the public spend will be channelled directly to R&D actors through national and regional instruments, complemented in some instances by structural funds from the EU, while other spend will be channelled to them more indirectly through other EU instruments, e.g. the Framework R&D Programmes.

In theory, in order to meet the overall 3% target, governments should be estimating the public budgets needed to reach their own national R&D intensity targets, taking into account the implications of expected changes in EU R&D and structural funds for national budgets since, for example, future increases in overall EU spend on R&D could have significant ramifications for the amounts of money channelled through national instruments. Ideally they should also take into account the leverage effect of public sector spend on private sector R&D levels, since low leverage rates will require greater levels of public spend, and *vice versa*. Moreover, if these estimates are conducted in a consistent fashion across EU countries, they could in theory be used as indicators of progress towards the overall 3% target.

In reality, many governments have set overall targets for R&D intensity (sometimes 3% or over, but more frequently below this level, especially in countries starting from a low base) and some have set explicit public and private sector targets, but the mechanisms used to estimate and establish these levels vary from one country to another and are rarely transparent. Most targets are set within the context of budgetary procedures that are a combination of top-down priority setting and bottom-up budgetary claims by departments, all within a framework of spending caps imposed by Ministries of Finance. Within these contexts, however, the techniques used to provide quantitative estimates of public budget requirements vary considerably. Some countries produce quantitative estimates of overall future public expenditure on R&D by working backwards from predefined targets and expected growth rates in GDP. Others take the bottom-up route and aggregate departmental estimates based on historical expenditure trends, surveys of the financial needs of the research community, stakeholder consultations or more arbitrary projections and assessments of perceived needs. Few countries, however, appear to estimate the leverage effect of public spend and factor this back into their estimates of public budget requirements.

The balance between national and EU funding is also given very little consideration in many countries' estimates of public budget requirements, despite the fact that there is a clear perception in a limited number of countries that this balance is important. For countries in receipt of structural funds, for example, the increasing amounts spent on the development of R&D infrastructures and the need to co-finance the R&D-related activities benefiting from these funds has obvious implications for public budgets. Some countries are also well aware that the success of their indigenous R&D communities in the competition for Framework funds is often dependent on significant prior investment of public funds in national R&D infrastructures and activities. Conversely, there is the temptation in other countries to react to increases in Community budgets and contributions by cutting national R&D expenditure levels, with Framework funding effectively substituting for more direct national funding. In most countries, however, there is a more limited appreciation of the ways in which national and EU streams of funding interact and affect estimates of public budget requirements.

Although scant attention is paid to the balance between national and EU funding in budgetary estimates, there is nevertheless a sound appreciation across the EU of the broad partition of roles and efforts between national and Community levels and the need to maintain the *status quo* in the period up to 2010. In general there is broad agreement that the structural funds should continue to provide complementary

funding for activities deemed to be of importance within national settings, e.g. the building or rebuilding of R&D infrastructures in the new Member States, whereas competitive Framework funding should be complementary in the sense that it supports activities providing European Added Value. This includes support for large scale and costly activities that individual nations cannot afford on their own; support for research in newly emerging areas of strategic importance to the EU as a whole; initiatives to improve human mobility; and support for networking, access to complementary expertise in different countries and the co-ordination of policy efforts across countries. There is also broad-based support for efforts designed to raise European standards of excellence in a global context, particularly in basic research; initiatives designed to improve the exploitation of R&D within a European context via greater access to loans and venture capital for SMEs; and an interest in tackling issues with EU and global implications in the fields of health, energy and the environment.

In terms of assessing the public budget requirements associated with the attainment of the Lisbon objectives, attempts to estimate both the leverage of public expenditure on private sector R&D levels and the implications of changes in EU funding for national budgets are important technical considerations. They are secondary, however, to broader attempts to understand the real drivers of change in public budgets for R&D, namely the new scientific, economic and societal challenges shaping the scope and scale of future investment in R&D. Foresight exercises are now frequently used to identify and scope these challenges, but there is still room for more determined efforts to assess the implications for public R&D budgets.

Efforts to determine appropriate levels of public R&D expenditure should also be based primarily on an appreciation of the key needs within national innovation systems. In some instances, when low levels of R&D investment are seen to be a factor limiting growth, policy initiatives specifically aimed at rectifying such weaknesses within innovation systems are needed. In other circumstances, e.g. when the efficient translation of R&D into innovation and diffusion is a problem, other measures and policy mixes designed to improve the wholesale performance of innovation systems by rectifying these weaknesses take priority, with increased R&D expenditure levels an indirect outcome of improved system performance rather than a direct policy priority. In most cases, however, appropriate policy mixes are likely to include a range of measures having both direct and indirect impacts on R&D levels.

2.4.2 Good Practices

At a technical level, it is difficult to talk about good practices when there is little evidence that any one country makes adequate provision for the interactions between either public and private spend or national and EU funding when estimating public budget requirements. There are examples, however, of sound budgetary setting processes that could be complemented by a greater appreciation of such interactions. These include combinations of top-down and bottom-up approaches (e.g. RO, but also many other countries); stakeholder consultations (e.g. SE, NL); the use of foresight exercises in priority setting (e.g. IE, PL); surveys of the needs and absorptive capacity of the R&D community (e.g. SI, ES, PT, HU, IL); estimates of public requirements derived by working backwards from specific R&D intensity levels (e.g. BE, IE, PL, UK); and estimates based on the aggregation of departmental projections (e.g. IE).

At a more strategic level, foresight exercises now have a ten-year history in many EU countries, and numerous monitoring and evaluation systems are in place to assess the performance of individual policy instruments. As noted elsewhere in this report, however, there is still scope for improvement in the development and application of processes and techniques capable of identifying weak spots in national innovation systems and suggesting appropriate, remedial policy mixes.

2.4.3 Recommendations

The methods used by governments to assess public budgetary requirements are neither consistent across countries nor based on adequate and reliable assumptions about either the partition of roles between nations and the EU or the leverage effects of public spend on private R&D investment levels. Perhaps more importantly, however, there is a critical need for Member States to consider the scale and scope of future societal challenges and scientific and technological advances and their implications for public R&D budgets.

CREST should invite the Commission to prepare simulations and share information on the ways in which potential increases in EU R&D and innovation budgets and structural funds might contribute to the attainment of the Barcelona targets and impact on Member States' public budget requirements. There is also scope for a review of the processes and techniques used by Member States to assess public R&D budget needs. CREST should therefore invite the Commission and Member States to conduct such a review and support the development of improved processes and tools, with a view to discussing their utility at future workshops.

Concerning the repartition of roles and efforts between national and Community levels until 2010, there is widespread acceptance of the conventional emphases on European Added Value within the Framework Programme stream of funding, and on strategic priorities at a national level within the structural funds stream. These points should be taken on board when formulating future strategies for both the Framework Programmes and R&D-related activities supported via structural funds. There is still a need, however, to reaffirm that EU funds should complement rather than substitute for national R&D funding.

Increases in both the EU R&D budget and the R&D budgets of Member States are likely if the overall target of 3% of GDP for the EU as a whole is to be met. CREST should thus advise Member States that increases in Community funding should not be offset by reductions in the relevant national budgets, since participation in national programmes often underpins success in the competition for Framework funding. Concerning Structural Funds, CREST should also remind Member States of the importance of dedicating an increasing share of these funds to the development of appropriate R&D infrastructures and related R&D activities.

2.5 Action 5 – Redirecting State Aid

- Redirect State Aid towards R&D as part of the more general redirection of State Aid towards horizontal objectives.

2.5.1 Patterns, Trends and Key Issues

As a result of the Barcelona and Stockholm European Council meetings, there is a strong imperative both to reduce State Aid as a percentage of GDP and to redirect it away from 'vertical' or 'sectoral' support', i.e. support directed towards specific industries, and towards 'horizontal' support, e.g. support for R&D (irrespective of which sectors conduct it), the environment, energy saving, employment, training, regional development etc. Although State Aid has been falling in recent years, the total amounts involved still mean that a further redirection to horizontal activities could lead to a substantial increase in the amount spent on R&D. Out of a total of €34 billion in 2002 (excluding State Aid to agriculture, fisheries and transport), €25 billion was directed towards horizontal activities, implying that 27% of total State Aid could still be redirected towards horizontal activities.

R&D support currently accounts for some €5 billion of this €25 billion. If this sum is to rise as more State Aid shifts from sectoral to horizontal support, the various departments and ministries responsible for R&D initiatives in national settings will invariably have to compete for resources with ministries responsible for other horizontal activities. Correspondingly, if they are to succeed in their claims, strong arguments in favour of increased support for R&D will be needed, including evidence that public sector policy efforts can leverage private sector R&D expenditure and lead, eventually, to improvements in general social and economic welfare.

Although there is general agreement across the EU that redirecting State Aid towards R&D is likely to influence both public and private expenditure on R&D, few qualitative accounts of actual impacts or quantitative estimates of expected impacts exist, particularly estimates of the leveraging effect on private sector R&D investment.[8] In the EU, some countries have been very successful in redirecting State Aid towards horizontal activities, R&D in particular, and further impacts in the future are likely to be small. In countries less advanced in their attempts to redirect State Aid, however, the scope for substantial impacts is correspondingly larger, though again the expected size of these impacts is difficult to ascertain.

Factors having a positive influence on the redirection of State Aid include recognition that a shift to horizontal objectives is needed to encourage restructuring and innovation, coupled with a strong government commitment to these shifts. EU efforts to introduce more favourable State Aid regulations for R&D and innovation have also played a part. Conversely, lack of government commitment and discontent with the current rules and regulations surrounding State Aid for R&D activities, exacerbated by lack of absorptive capacity in industry and weak innovation cultures, have impeded efforts to redirect State Aid in many quarters.

[8] The Expert Group noted that a study to assess the leverage effect of State Aid on R&D intensity in the EU had just been launched by the Commission.

Across the globe there are rules governing the legitimacy of public support for different kinds of activity, including R&D. In the EU, the current rules governing State Aid for R&D allow 100% support for fundamental research, 50% support for industrial R&D, and 25% support for what is defined as pre-competitive development activity[9]. Currently there is a debate about the need to modify these rules and the potential impact of these changes on R&D investment levels and the leverage of public funding on private R&D activities.[10]

In part, the failure or reluctance of some countries to redirect State Aid may also be due to a limited understanding of the ways in which State Aid functions and, in particular, confusion between the redirection of State Aid and the refocusing of public spend. Redirecting State Aid is similar but different to the refocusing of public spend on R&D. The latter involves increasing the percentage of public spend on R&D via the diversion of spend on non-R&D activities to spend on R&D activities. The former involves increasing the proportion of State Aid devoted to R&D via the diversion of State Aid from non-R&D to R&D activities. They are only equivalent if public spend and State Aid are equivalent, which they are plainly not, since State Aid is itself only a relatively small proportion of overall public spend. There is enough overlap, however, for some Member States to conflate actions designed to refocus public spend with those designed to redirect State Aid.

This confusion between the refocusing of public spend and the redirection of State Aid is unfortunate, since many actions implemented to refocus public spend will not necessarily affect the levels of State Aid to R&D activities and the opportunity to leverage private sector investment in R&D. Given this situation, the Expert Group notes that the Commission Services are preparing a vade mecum on State Aid for R&D and looks forward to its widespread distribution.

2.5.2 Good Practices

The State Aid Scoreboard published by the EU[11] provides details of the extent to which countries have been successful in redirecting State Aid to horizontal activities such as R&D (see Exhibits 2 and 3 for the latest available figures). Excluding aid to agriculture, fisheries and transport, the EU-15 countries with the greatest share of State Aid directed to horizontal objectives in 2002 were Denmark, Greece, Finland, the Netherlands, Belgium Italy and Austria. However, in terms of the share of State Aid directed to R&D as a proportion of total State Aid (again excluding State Aid to agriculture, fisheries and transport), the top ranking countries in 2002 were Finland, Austria, the Netherlands, the UK and France. Whereas countries such as Finland, Austria and the Netherlands have chosen to redirect large proportions of horizontal State Aid towards R&D, other countries successfully moving away from sector-specific State Aid have chosen to focus on alternative forms of horizontal support e.g.

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[9] These levels are higher for SMEs, for R&D conducted within the context of regional development support and for European and co-operative research.

[10] See the section on competition policy in 'Raising EU R&D Intensity', the report to the European Commission by an independent expert group on 'Improving the effectiveness of the mix of public support mechanisms for private sector research and development', ISBN 92-894-5578-0

[11] See http://europa.eu.int/comm/competition/state_aid/scoreboard/indicators/k5.html

environment, employment and training in Denmark and regional development in Greece and Ireland.

Amongst the new Member States (see Exhibit 3), only Hungary has almost fully eschewed the use of sectoral State Aid, though the form of horizontal State Aid favoured is regional aid rather than support for R&D, which stands at around 1% of total State Aid. In contrast, both Slovenia and Slovakia have R&D support levels around the 12% mark – comparable with the norm for the EU-15 countries.

2.5.3 Recommendations

Some Member States have been very successful in redirecting State Aid towards horizontal activities such as R&D. Other countries, via their representatives in the Expert Group, have expressed a willingness to learn from these experiences.

CREST should invite interested Member States with successful track records in the redirection of State Aid to horizontal activities in general, and to R&D in particular, to prepare material indicating why and how this was accomplished, with a view to the production of a guide for the use of other Member States.

Exhibit 2 – State Aid in the EU-15 Countries, 2001

State Aid, EU-15 (2002)	Percentage of total aid less agriculture, fisheries and transport															
	EU	**BE**	**DK**	**DE**	**GR**	**ES**	**FR**	**IE**	**IT**	**LU**	**NL**	**AT**	**PT**	**FI**	**SE**	**UK**
Horizontal (incl. regional) objectives	**73%**	**97%**	**100%**	**66%**	**100%**	**67%**	**60%**	**49%**	**96%**	**92%**	**98%**	**96%**	**39%**	**98%**	**84%**	**70%**
Research and Development	15%	15%	5%	14%	10%	12%	18%	8%	13%	9%	26%	33%	5%	0%	18%	27%
Environment	16%	0%	53%	30%		4%	3%	0%	0%	0%	39%	19%	5%	38%	39%	5%
SME	14%	20%	1%	6%	16%	20%	17%	2%	33%	21%	4%	17%	15%	12%	5%	15%
Commerce	1%	0%		0%		0%	2%		2%	1%	5%		0%	7%		0%
Employment aid	2%	7%	34%	0%		3%	0%	8%	1%		0%	4%	6%	11%		0%
Training aid	2%	2%	3%	0%		8%	0%	4%	1%			10%	5%	0%	1%	2%
Other objectives (1)	23%	52%	3%	16%	74%	19%	18%	26%	46%	61%	24%	14%	3%	29%	21%	21%
Particular sectors (excl. transport, incl. for rescue and restructuring)	**27%**	**3%**	**0%**	**34%**	**0%**	**33%**	**40%**	**51%**	**4%**	**8%**	**2%**	**4%**	**61%**	**2%**	**16%**	**30%**
Manufacturing	3%		0%	4%	0%	5%	2%	35%	3%		2%	4%	4%	0%		1%
Coal	16%			30%		28%	16%									1%
Other non-manufacturing sectors	2%					0%	0%		0%			0%				28%
Financial Services	5%						22%	14%					57%			
Other services	0%	3%		0%		0%		3%		8%			0%	2%	16%	
Total aid except for agriculture, fisheries and transport in million €	**34005**	**933**	**1274**	**11431**	**410**	**3503**	**6197**	**525**	**4528**	**56**	**780**	**453**	**649**	**231**	**406**	**2629**

(1) Includes aid for general regional development not classified elsewhere.

Source: DG JRC-IPTS calculations based exclusively on DG Competition's State Aid Scoreboard

Exhibit 3 – State Aid in the Non-EU-15 Countries, 2000 (1)

State Aid, EU-Non-15 (2000)	Percentage of total aid less agriculture, fisheries and transport										
	BG	**CY**	**CZ**	**EE**	**HU**	**LV**	**LT**	**PL**	**RO**	**SK**	**SI**
Horizontal (incl. regional) objectives	**17%**	**45%**	**24%**	**60%**	**97%**	**30%**	**8%**	**68%**	**30%**	**24%**	**71%**
Research and Development		1%	5%	7%	1%		0%	1%	1%	12%	12%
Environment	1%	2%	0%	43%	3%			5%	3%	0%	46%
SME		21%	12%	0%	4%		2%	0%	5%	2%	8%
Commerce		3%		10%		1%	2%				
Employment aid	1%		3%					28%			1%
Training aid		7%							1%		
Other objectives (1)	16%	11%	4%		88%	29%	3%	33%	19%	9%	4%
Particular sectors (excl. transport, incl. for rescue and restructuring)	**83%**	**55%**	**76%**	**40%**	**3%**	**69%**	**92%**	**32%**	**70%**	**75%**	**29%**
Manufacturing (2)	32%	19%	35%			55%	0%	9%	35%	53%	19%
Coal	34%		15%		2%			22%	12%	6%	7%
Other non-manufacturing sectors	14%						92%	2%	21%	14%	
Financial Services		5%	25%			14%			0%		
Other services	3%	31%	0%	40%	1%				3%	3%	3%
Total aid except for agriculture, fisheries and transport in million €	**118.2**	**87.3**	**571.2**	**4.2**	**538.3**	**27.4**	**43.2**	**1619.5**	**527.4**	**64.3**	**165.4**

(1) New Member States (apart from Malta) and Candidate Countries (apart from Turkey).
(2) Includes aid for general regional development not classified elsewhere.
(3) Includes aid for the steel sector as well as aid for rescue and restructuring not classified elsewhere.
Source: DG JRC-IPTS calculations based exclusively on DG Competition's State Aid Scoreboard

3 Conclusions

The nature of the work undertaken during the first cycle of the OMC was exploratory in nature. As indicated in the introduction, the intention was to explore the feasibility of six potential tasks and deliverables associated with the implementation of five of the Action Lines specified in the Commission's Action Plan on investment in R&D. These tasks and deliverables ranged from a review of current developments relevant to each Action Line and the identification of good practices, to concerted attempts to specify relevant indicators of progress, the development of joint actions between Member States, the formulation of EU guidelines of potential use to Member States, and the identification of any other initiatives likely to lead to fruitful outcomes.

There were many positive achievements associated with the conduct of this work, especially in terms of mutual learning. The presentations by members of the Expert Group on their own national situations and policy mixes stimulated debate and the exchange of information on particular instruments, processes and issues. As part of an exercise to gather data on developments, trends and good practices within the countries taking part in the exercise, the questionnaire circulated to CREST representatives also provided both an overview of policy mixes in the EU (see Appendix 1 for the synthesis report prepared by DG JRC-IPTS) and a guide to developments in 26 separate countries.

As befitting an exploratory exercise, however, progress was modest. This was primarily due to the complexity of the subject matter and the unfamiliarity of many national administrations with some of the concepts and practices involved in the design and implementation of comprehensive policy mixes, particularly those capable of improving the performance of national innovation systems and enhancing R&D intensity. This emphasised the need for mutual learning, but complicated not only the collection of adequate data on the policy mixes in place in different countries and the assembly of information relevant to each of the Action Lines, but also the identification of good practices in each area. As one member of the Expert Group opined: "It is difficult to identify and scale the heights while we are still struggling in the foothills". It meant, too, that less time than anticipated was spent on tasks such as the identification of relevant indicators, the development of EU guidelines and the development of joint actions. In terms of the overall feasibility of these tasks, the complexity of the topic and the difficulties involved in the exercise nevertheless demonstrated the potential for mutual learning in the second cycle of the OMC and a cautious approach – involving the greater use of external specialists – in the evolution of relevant indicators of progress and guidelines for each of the Action Lines.

A number of other factors also affected progress. Lack of familiarity and operational experience with the OMC played a part, as did an initial feeling (which continues in some quarters) that the exercise might duplicate existing work at national and international level, with the consequence that it took some time for a strong sense of commitment and collective ownership of the process to emerge. There was also a sense that the meetings of the Expert Group were both too numerous, in terms of the demands they made on individual members, and yet insufficient in number for the Group to tackle all its roles and fulfil all its responsibilities (e.g. getting to grips with unfamiliar concepts; collecting and synthesising data; sharing experiences; spotting

good practices where few criteria exist to judge performance; identifying indicators and guidelines in areas where even specialists struggle; assessing the feasibility of different tasks; and reviewing and recommending potential options for the future).

In terms of activities in the second cycle of the OMC, all of these factors suggest the adoption of an approach with the following characteristics:

- A continued emphasis on mutual learning and the sharing of experiences;
- A more focused approach that concentrates efforts on a limited number of topics and allows individual Member States to devote efforts and resources to those issues which most interest them;
- The constitution of an Expert Group which meets in plenary only three times during the cycle:
    - once at the beginning of the cycle to plan activities;
    - once at the mid-point of the cycle to check progress;
    - and once at the end of the cycle to synthesise results and suggest next steps;
- The formation of Sub-Groups or Interest Groups composed of volunteers from interested Member States to work on specific topics and report to the plenary session of the main Expert Group;
- The use of external assistance to complement the work of the Interest Groups.

The final choice of topics upon which to concentrate in the next cycle will depend very much on the recommendations that CREST chooses to support and the willingness of Member States to work further on them. In terms of priorities, however, the Expert Group has a number of modest suggestions to make.

In the first instance, the aim of sharing experiences and mutual learning can best be achieved via the adoption of the recommendation concerning **peer reviews of national policy mixes** (see Section 2.2.3 and Executive Summary: Recommendation 4). The Dutch Government has taken the lead in discussions about the feasibility of such an approach, informal contacts with OECD suggest there is scope for collaboration, and enough members of the Expert Group have expressed an interest in taking part in peer reviews for a small number of pilots to be launched during the second cycle of the OMC, though only once a designated Interest Group has evolved a suitable way of spelling out the cost implications and operationalising the concept. Depending on the success of these pilots, further peer reviews of policy mixes in other volunteer countries can then take place during subsequent cycles of the OMC.

Secondly, there is a strong interest amongst the members of the Expert Group in **the preparation of illustrative material and exemplars concerned with innovative ways of increasing the funds available to government for actions likely to raise R&D investment levels** in both the public and private sectors. This includes material on the refocusing of public spend (see 2.3.3 and Executive Summary: Recommendation 6) and the redirection of State Aid (see 2.5.3 and Executive Summary: Recommendation 10). An Interest Group, suitably supported, could be charged with the collection of such material and the preparation of indicative guidelines.

Third, consideration of public budget requirements if the 3% target is to be met can best be progressed via a focus on both **the challenges and opportunities likely to**

stimulate increased R&D funding in the future and the processes and techniques that can be used to assess the financial implications of responding to them (see Section 2.4.3 and Executive Summary: Recommendation 8). Again an Interest Group, suitably assisted by external expertise, could be assigned to review the results of foresight exercises, organise workshops on future challenges and collect and prepare relevant examples of good practice in the use of budgetary assessment techniques. Member States and the Commission could also be invited to support research into the development of better assessment techniques in this area.

Fourth, there is an urgent need to constitute an Interest Group with specialist expertise in **the development and use of indicators capable of tracking the evolution of innovation systems and illuminating the performance of innovation system policies**. The specific remit of this Interest Group would be to explore the feasibility of relevant indicators via liaison with relevant bodies operating in this sphere (DG RTD, DG Enterprise, DG JRC-IPTS, Eurostat, OECD, National Statistical Offices etc.). The immediate objective would be to avoid overlap and ensure a degree of coherence between all the initiatives currently tracking the performance of innovation systems and R&D and innovation policies. The eventual aim would be the constitution of a 'knowledge base' or 'intelligence service' akin to the TrendChart initiative of DG Enterprise, but covering R&D as well as innovation-related activities (see Section 2.2.3 and Executive Summary: Recommendation 1). Furthermore, this Interest Group would also be charged with progressing work on the commensurability of the data collected and presented in national reports across the EU (again see Section 2.2.3 and Executive Summary: Recommendation 2), and the use of appropriate indicators to track the refocusing of public spend on knowledge-related activities (see Section 2.3.3 and Executive Summary: Recommendation 7).

A fifth priority to be tackled by an Interest Group and external support services would involve **exploratory efforts to develop and implement pilot systems to monitor and assess the performance of R&D and innovation policy mixes in national settings**. Similar in nature to the peer review initiative, the Interest Group would be charged with overseeing the review, choice and implementation of a suitable methodological approach and in its operationalisation in one or more volunteer countries (see Section 2.2.3 and Executive Summary: Recommendation 3).

Appendix 1

Analysis of Questionnaire CREST Expert Group on Public Research Spending and Policy Mixes

Prepared for

Directorate General for Research
(DG RTD–M)

by

European Commission
DG JRC-IPTS

With contributions from A. Brandsma,
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A. Skulimowski (PBF –PL), M. Zitt (OST – F)
and P. Brenier (DG RTD)

Seville, 16th June 2004

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Analysis of Questionnaire Expert Group on Public Research Spending and Policy Mixes

Background

At the initiative of the Expert Group a questionnaire was set up and sent to CREST representatives for completion. Responses were received from the following 26 of the 33 countries:

BE	Belgium	IT	Italy	SK	Slovakia
BG	Bulgaria	LV	Latvia	SI	Slovenia
DK	Denmark	LT	Lithuania	FI	Finland
DE	Germany	LU	Luxembourg	SE	Sweden
EL	Greece	NL	Netherlands	UK	United Kingdom
ES	Spain	AT	Austria		
FR	France	PL	Poland	CH	Switzerland
HU	Hungary	PT	Portugal	IL	Israel
IE	Ireland	RO	Romania	NO	Norway

Responses from the Czech Republic, Cyprus, Estonia, Iceland, Liechtenstein, Malta and Turkey had not been received at the time when this analysis was completed.

The 26 responses are summarised, grouped and itemised in this analysis in support of the work of the CREST Expert Group #5 by DG JRC-IPTS[12] – in collaboration with DG RTD – with input from a group of Senior Experts from the ESTO network. **The purpose of this overview and analysis is to assist in the reading of the Questionnaires across countries, to facilitate discussions within Expert Group #5.**

The sections were analysed in detail by JRC-IPTS staff and ESTO[13] experts as follows:

Questionnaire sections	**JRC-IPTS Staff**	**ESTO Senior group member**
1. Policy Context	M. Boden	Torsti Loikkanen, VTT
2. Design Policy Mixes and Optimise Financing Instruments	T. Döry	Claire Nauwelaers, MERIT
3 Refocus Public Spend	C. Ciupagea	Michel Zitt, OST
4. Public Budget Needs	A. Brandsma	Luis Sanz-Menéndez*, CSIC
5. Redirect State Aid	P. Moncada-Paternò-Castello	Andrzej Skulimowski, PBF

(*) With the collaboration of Laura Cruz

Patrick Brenier (DG RTD) provided useful input to the present document and contributed in the workshop organised with the ESTO Senior Experts Group.

[12] The **Institute for Prospective Technological Studies** (IPTS) is one of the seven scientific institutes of the European Commission's Directorate General Joint Research Centre (JRC). It was set up in 1994 to enhance understanding of the links between technology, the economy and society. Its mission is to provide European policy makers with techno-economic analyses and policy support. http://www.jrc.es/home/index.html

[13] **The European Science and Technology Observatory (ESTO) is a network** of organisations operating since 1997 under the leadership and funding of the European Commission's Joint Research Centre (JRC) – Institute for Prospective Technological Studies (IPTS). The network includes the organizations that contributed in the present analysis: VTT – Technical Research Centre of Finland, Technology Studies; MERIT – University of Maastricht, Economic Research Institute on Innovation and Technology; OST – Observatoire de Science et Technologie, Paris; CSIC – Consejo Superior de Investigaciones Cientificas, Madrid; PBF – Progress and Business Foundation, Kraków. http://esto.jrc.es/

Summary

There is broad recognition that R&D and innovation are the key to economic growth and that improvements in the innovation systems in European countries are needed to catch up with the performance of other parts of the world. Education and science, combined with entrepreneurial skills and risk taking, are seen as the main generators of innovation, but also as activities being driven by motives other than their possible contributions to economic growth and competitiveness.

Together the responses to the questionnaire point to an impressive set of measures and strategies to promote research and development and innovation in the responding countries. They also show broad endorsement of the target to raise R&D expenditure in the EU to 3% of GDP, mostly taken as applying to each Member State separately. However, most of the policy statements refer to general objectives rather than specific implementation schemes. Moreover, only some countries include their public budget requirements in the R&D and Innovation strategies.

The questions on the Policy Context aimed at identifying the drivers of national science, technology and innovation policy, the indicators used to track progress towards reaching the goals on R&D expenditure and the factors which have had a positive or negative influence. This section of the Questionnaire also includes questions on the impact of EU policy objectives and on specific national initiatives and measures to improve the supply and stimulate the demand for R&D personnel. Whereas the most quoted driver of policy is the improvement of economic performance and competitiveness, in wording close to the Lisbon agenda, the answers highlight the **lack of adequate resources to address research investment needs, both in the public and private sphere of interest**:

- The **strength of the public sector research base** is considered to be a major national asset by the great majority of the respondents.
- **Insufficient public funding** is identified as the main negative factor by most respondents.
- Very **few specific measures** are being put forward **to promote R&D in the private sector** or to simulate private sector demand for R&D personnel.
- Promoting **regional development through research and education** is highlighted by a number of countries (Belgium, Hungary, Italy, Poland and Slovakia).

The answers to the questions on the Design of Policy Mixes again show that the responding countries have many measures in place which affect R&D and Innovation, but only a few Member States (Hungary, Ireland, the Netherlands) present them as components of a comprehensive strategy. Without exception, the responsibility for the implementation of the measures is split between different institutional actors. This made it difficult for the respondents to give an overview of the budgetary implications.

There is a great deal of overlap between the answers to the sections on the Refocusing of Public Spend and the first two sections of the Questionnaire. When asked to delimit "knowledge-related" activities, the respondents tend to take a broad view and include education, information society and employment issues. When asked about the refocusing of public expenditure, they refer mostly to shifts within the more limited area of science and research.

Similar limitations apply to the answers in the sections on Public Budget Needs, which are mostly restricted to the budgetary appropriations for R&D, notwithstanding other relevant categories of government expenditure. Typically, budget negotiations between ministries cover only part of the measures affecting R&D and Innovation. There is little indication of systematic programme evaluation. The results of studies on the possible impact of R&D on future competitiveness, growth and employment are very rarely taken into account. Whereas several

countries put forward their National Development Plans as a framework for measures to stimulate R&D and Innovation, scant consideration is given to the balance between EU and national funding. There is rather wide agreement on gaps to be filled at the EU level: large-scale research infrastructure; trans-national research networks; search for excellence in basic research; facilitation of trans-national mobility of researchers; and provision of equity financing for innovative small and medium-sized enterprises (SMEs).

The responses on the Redirection of State Aid illustrate the limited influence of the respondents on public finance decisions at the government level. Little evidence is provided neither on the volume of State Aid nor on national measures to redirect State Aid from sectoral support to horizontal/regional objectives. This redirection has already occurred in many Member States as a result of legislation on State Aid and peer pressure at the EU level. The responses, in particular those from the new Member States, show appreciation for the role of EU legislation, but some express doubts about the need to notify support to R&D. However, this can be linked to a lack of information on the recently adopted block exemption for support to R&D in SMEs.

Whereas there is ample evidence of the endorsement and understanding of the Barcelona objectives among Member States and Associated Countries – and clear signs of a convergence of views on what can and should be done at the EU level – few countries seem to envisage substantial changes in their domestic policies as a result of the OMC-3%. Nevertheless, many countries have introduced, or are in the early stages of implementing new measures in the context of innovation strategies and plans, with in particular increasing reliance on tax incentives for R&D investments and young technology based enterprises. The formulation and implementation of policy mixes to ensure consistency and maximise synergy between different policies and public support mechanisms – coordinated at the level of the government – remains to be developed.

Analysis

A detailed analysis of the answers to the questions in each Section of the Questionnaire is given below.

1. Policy Context

1.1 What are the main drivers of science, technology and innovation policy within your country?
Please describe in terms such as the need to restructure industry, improve competitiveness, strengthen the science base, raise R&D investment levels, improve the performance of the national innovation system, promote regional development etc.

Clearly, there are some issues of the interpretation of exactly what are "drivers". The responses interpret them intermittently as motives and means. Although all responses explicitly or implicitly adhere to the Barcelona objective, they enter the motivation of why and how to get there at different levels.

In a number of cases ***general drivers*** are cited such as overall improved economic performance, competitiveness and prosperity (LV, SK, SI, BG, LU, FR, DE) and more explicitly acknowledgement of the role of research and innovation in growth (HU, SE, NO, EL, RO, DE, LT). In certain cases, specific economic drivers are given: the rate of productivity growth (UK), labour productivity (NL) and employment (BE).

The BG and EL responses emphasise the benefits to ***society*** of science as a curiosity-driven activity, even irrespective of its economic effects. FI: the "sustainable development of the Finnish economy and society by means of knowledge, know-how and innovation".

There are explicit moves towards the ***knowledge-based economy*** (BE, HU, IE, DK, EL, LT, FR) and related activities such as the strengthening of the science base to generate new knowledge (NO, BG, LU, EL, RO, DE, LT), development and accumulation of 'knowledge capital'(IE) – otherwise expressed as human resources (HU, ES, PT) – including strengthening the education system (SI, EL, NL).

Developing the structure and operation of effective ***National Innovation Systems*** is widely cited (LV, SK, CH, HU, SI, ES, EL, LT, PT, AT, IT) with significant explicit attention to public sector research capability (IE, IL, LV, HU, CH, UK, DK, SI, ES, LU, NL, RO, IT).

There is a need to improve and continue to exploit ***public-private linkages*** and technology transfers (HU, PL, DK, ES, LU, EL, LT, PT). Several respondents emphasise the enhancement of private sector research and innovation capability (IE, IL, HU, LV, ES, RO, PT) and funding (DK, NO, ES), including giving particular attention to SMEs (HU, LV) and ***venture capital*** (DK). Some also stress the need to ***attract foreign investment*** (LV, HU, IE, EL) and other funding from abroad (PL). Foundations (non-profit institutions) also have a role to play (FR).

Other drivers:
- promoting ***international cooperation*** in science and technology (SI, RO), such as by opening up national programmes to partners from abroad (EL); creating poles of excellence, attractive at international level (FR)

- promoting ***regional development*** (BE, HU, IT, PL, SK), particularly for research and education (NO, EL); the coordination between research and innovation policies and ***regional*** policies (ES, RO)
- the need for ***industrial restructuring*** (PL, RO), changing the pattern of specialisation (PT), linked to aspects of modernisation and alignment with the EU15 (HU, LV, SK); in a longer-term perspective (NO)
- ***Environment*** (HU)

Other issues which are cited, but not so much as "drivers":

Implementing the results of National Foresight exercises (PL, EL, BG in its response to 1.2, DK in response to 1.5); specific areas of advanced technology (HU), information society technologies (EL); agriculture/food, and marine (IE); visibility in society (ES); aspects of the national legal (HU, BG) and fiscal (CH, PL, BG) framework for innovation, including intellectual property rights; the need to encourage entrepreneurship (DK).

1.2 To what extent and how have the targets for R&D investment set by the European Council in Barcelona influenced your government's policies and actions?
For example, has a national R&D target been set? Has a multi-annual Action Plan been initiated? Have there been changes in the governance of R&D and innovation? Have new measures been introduced? Are there plans to introduce new measures in the near future?

The endorsement of the 3% target is unanimous. Some countries recognise that they will not be able to reach this target by 2010 and have set more realistic targets for the medium term. Research spending may be more efficient in one country than another and the positions of different countries may shift over time, depending on national income and public finance limitations.

Target already achieved
- IL – R&D expenditure at 4.2% of GDP in 2002
- SE, FI – already reached the 3% goal

Explicit adoption of the targets and their formal incorporation into the policy framework and mechanisms
- BE – Both federal and regional levels, but not yet linked to each other
- IE – Giving high priority to assessing the implications of the 3% and making an explicit contribution
- NL – Endorses this aim and regards the 3% target as a beacon for research and innovation policy, but it is also seen as an input indicator, whereas the Dutch policy mixes and its instruments are designed to produce optimal output.
- SI – Committed to the 3% target; the new law on Research and development was adopted by the Parliament of the Republic of Slovenia in the year 2002. It also has specific intermediate annual targets.
- DE – 3% target is included in the current government programme. Innovation policy is a top priority.
- LT – National Multi-annual (2003-2015) Action plan for R&D strategy includes 3% targets, backed up by a number of specific strategic objectives.
- AT – The Austrian Council for Research and Technology Development sees its National Research and Innovation Plan as an integral component of the Lisbon process.
- FR – High level commitment to Barcelona target; increased public research budget for 2004; multi-annual plan under preparation.

The main tendency is to set realistic related national targets and specific activities to achieve them

- EL – target of 1.5% by the end of 2010, with at least 40% from industry.
- HU – strong links, aiming at 2% by 2010 (abandoned previous target of 1.8% by 2006), not a compulsory target but a "shared strategic vision"
- DK – further public sector research investment – no specific target given, also possible joint European actions mooted
- LV – level of 2% (including the private sector share 1%) to be reached by 2010 - not yet been approved by the Government)
- PL – 1.5% of GDP in 2006 (2/3 should come from private sector) and related action plan to be launched
- NO – national target is to reach OECD average by 2005, with Barcelona as a key point of reference
- ES – the Barcelona target has been considered within the Spanish R&D&I Plan 2004-2007, which has quantitative targets on economic resources and results
- IT – reaching the 3% target will be particularly difficult due to high proportion of SMEs in industrial sector; target of 1.75% in 2006. 1% of GDP in public sector.

A plan is imminent

- RO – currently finalising a draft National plan for public funded research to reach 1% and private sector 2% by the same year, including the planned establishment of an Interministerial Council for the National 3% Action Plan
- SK – National action plan to be approved in May 2004
- BG –There are a number of measures at different levels (legislative framework, improved fiscal environment, Foresight for R&D etc) and discussion of new multi-annual plan
- LU – Government fully endorses the Barcelona target, but no target setting in this context so far. (In 1999, government set the target for public funds of 0.3% and this was met). An interministerial working group will elaborate and design a multi-annual action plan
- PT – has the objective of a meaningful increase in GERD/GDP and multi-annual plan to promote innovation is in preparation.

No specific target or plan

- UK – whilst levels of R&D are considered an important determinant of innovation performance, the UK has not set a specific target for R&D
- CH – not in EU, no specific target, but monitors progress, also as a consequence of other activity, should increase from its current level of about 2.6% to 2.8% of GDP in 2007.

1.3 Is there a specific initiative or set of initiatives aimed at raising R&D investment levels, or are efforts likely to affect such levels subsumed within broader efforts aimed at improving the efficiency of the research system, or improving the performance of the national innovation system as a whole?

The main specific initiatives to improve the efficiency of research spending are the streamlining of policy instruments (from 30 to 6 in NL) and (proposals of) tax credit schemes (DK, NO, FR). DK plan to introduce tax deduction of 150% to business enterprises on sponsorships to research and researcher schools at the universities and government research institutions. FR in response to 1.2: plan to double the amount available for the tax credit scheme for R&D in three years and introduce a specific statute for young innovative enterprises (benefiting from tax social exemptions and income tax reductions). Subsumed within broader efforts:

Concerted national multi-annual plan

IE, LV, SK, SI (range of programmes), CH, HU, ES (increasing R&D intensity with balanced mixture of grants, loans and subsidies), SI (with emphasis on development of common platforms for research), DE (placing innovation at the top of the policy agenda)

Emphasis on Improving Innovation System
UK (improving framework conditions or other policies, taxation, venture capital); NO (general conditions to provide sound foundation for research and innovation); NL (improving innovation climate and activities through a balanced and structured mixes of tools); BE, HU, DK, FI (focus on single ministry, reform of entire public research and innovation system); EL (emphasis on interface between public and private research performers at regional, national and global level); RO (increased public investment in national programmes and infrastructure, stimulation of private investment and knowledge transfer, attracting and training more human resources); LT (improving the efficiency of the national R&D and innovation system as a whole).

Specific measures/emphasis
BE (at all levels of authority), DK (public-private links), PL (financing and improved evaluation system), SE (current emphasis on basic research but new initiatives foreseen), IL, NO (sector specific measures, tax incentives for companies, strengthening the role of universities in national innovation system and an evaluation of the role of technical and industrial research institutes), LU (emphasis on public-private cooperation, through national research funds and co-financing), BG (initiatives for development of research and innovation activities, accelerating integration in EU, SMEs), PT a number of relevant initiatives (on knowledge and innovation, supporting R&D projects in strategic sectors, in the information society area, public administration and education, a scheme for the provision of fiscal incentives, and an innovation programme, composed of schemes targeted at various sectors).

1.4 Are specific actions or measures being put in place to improve the supply and stimulate the demand for highly educated and trained research personnel?

The actions are not very specific mostly directed to improve the supply of research personnel both at home and from abroad. Specific financial measures in Italy help young people enrolling in Physics, Chemistry and Mathematics. On the demand side, all the research contracts awarded to Italian industry require the hiring of young researchers for 10% of the total credits awarded.

To improve the supply of postgraduate S&T researchers
Measures to improve the supply of S&T (post)graduates (LV, PL, SK, UK, DK, HU, EL, ES, SI, BG, NL, RO, DE, LT, PT) and improve the quality of higher education more generally (BG, DE, LT), as well as measures to stimulate the demand for S&T graduates (EL, LU). Focus on support for doctoral research (SK, SE, CH, NO, LU) more basic research (EL), and reforms in higher education system (DK, HU, IE, LT) the development of the research school system (FI).

To improve career prospects and the attractiveness of research careers
Initiatives to make research careers more attractive (BE, UK, DK, HU, IE, ES, BG, NL, RO, LT, FI) especially for researchers from abroad (EL), retain and recruit researchers in the public sector (UK, IE).

To increase the mobility of researchers
Enhance the international mobility of researchers (BE, DK, HU, EL, RO, LU), enhance mobility between industry and universities (BE, HU, IE, EL, ES, SI, RO, NO, PT) in line with market needs (IL) and including placement of PhD students in enterprises (EL). Reverse mobility - encourage return and reintegration (HU).

To improved the supply in specific fields
Offering courses to meet demands in areas such as Biotechnology (IL, IE), ICT (IE), Physical sciences (IE), Public Administration (PT). Courses for technicians (IL).

Other aims: Gender equity (IE); public awareness (EL); recognition of non-formal learning (LT).

1.5 What indicators are being used at a national level to track progress towards the attainment of R&D investment policy goals? Are new ones being contemplated or developed. If so, please say what these are.

N.B. Commission proposal on set of 22 indicators can be found in http://europa.eu.int/comm/research/era/3pct/pdf/ann5.pdf

Use of accepted international indicators (EU, OECD) of research input (financial and human resources) and output (patents, technology trade) in the public and private sectors by national statistical offices (Frascati definitions)
(BE) (HU) (DK) (IE) (IL)(LV)(PL)(SK)(CH)(UK)(EL)(SL)(LU)(NO) (BU) Use of CIS (UK) (PT) (DE) (LT) (FI) (FR) (AT) (IT)

In addition, there is evidence of a ***process of transition*** from these traditionally used S&T indicators of input, to new sets of indicators, reflecting better impacts on competitiveness, in order to ensure conformity with EU indicators (RO) and the Development and use of specific indicators at regional level (BE).

Summary table of other indicators and related activities in responses:

	INPUT	***OUTPUT***
INNOVATION	Collaborative projects as % of applied and development government financed projects (SI) Young researchers employed by the business enterprises as % of young researchers "produced" by the national scheme "Young researchers programme" (SI) PhDs in private sector (ES), insertion of engineers in SMEs and Technology Centres (ES) % Innovative enterprises with innovation cooperation (NL) Financing of non-profit institutions (FR)	Annual reports prepared by independent economic research institutes, describe the development of innovation (DE) SME activity (SK), numbers of spin-offs (SE) and start-ups (NO) Creation of competitiveness observatory monitoring of innovation and research policy (LU) innovative enterprises as % of total number of enterprises (NL) % innovative enterprises in manufacturing and in services (NL) % Turnover due to new products in manufacturing (NL)
RESEARCH	System of cost accounting for universities (CH) Studying the possibility of introducing relevant indicators on PhD holders (gender, mobility patterns etc.) (EL) Joint projects (two or more government or higher-education research organisations) as % of national projects financed by the government (SL) Net increase of research positions in the public sector (ES) Internationalisation of research programmes (NO) Distribution of Regional research density (BG) Indicators on science-industry linkages (FR)	% of return from Framework Programme (ES) Specific schemes and programmes with specific indicators (HU, EL,) Development of a new and comprehensive set of indicators to monitor the implementation of the 2004-2007 federal plan (CH) and national plan (SI) Evaluation process for research, including ERA action Plan (DK) Bibliometric indicators (publications and citations) (DK, NO, LT, BU) % world scientific production (ES) Set of indicators of relative international research performance in science and engineering (UK)

1.6 What are the main factors in your country affecting the attainment of higher R&D investment levels? Please mention factors having a positive influence as well as those having a negative influence.

For example, factors affecting goal attainment negatively might include insufficient numbers of R&D personnel, lack of public funds to leverage private sector R&D or low absorption capacity for the fruits of technological innovation etc. In contrast, factors affecting attainment levels positively might include the existence of highly creative and innovative firms and a stable macroeconomic environment.

POSITIVE INFLUENCE

- Investment in public sector/research base (BE, HU, LV, PL, SK, UK, NL, BG, NO, ES, PT, FR, DK)
- Quality of private sector (CH, PT); specialisations: (BE - chemicals and pharmaceuticals), (HU – high tech and services), (EL – renewables, fish and food, software), (DE – car manufacturing and high-tech); high level of patenting (NL); awareness of industry of role of innovation (SI); some globally successful companies (FI); size of market (FR); innovative capacity of SMEs (AT); attractiveness to foreign firms (HU, PT)
- Availability of funding: (BE – public); (IL- Venture capital, international funding); (SE – seed capital) (NL- co-financing); (SI - strong government commitment); (PT – cooperation between research centres and private sector)
- Stable macroeconomic framework (BG, LU, LT, FI, AT)
- Developing and accessing European/FP Links (HU, SK, BG, RO, PT)
- Strong role of government in priority setting (ES, PT)
- Opportunities from public sector procurement (UK)
- Supportive legislative framework (BG, LU)
- ICT infrastructure and access to it (BG, NL, NO) and technological infrastructures (PT)
- Human resources (NL, PT, DK) and knowledge workers (NO)
- Effect of knowledge perspective on improving national innovation system (LT)
- Adaptive capacity (RO)
- Positive influence of 3% target (LT).

NEGATIVE INFLUENCE

- Concentration of industrial research (BE, SE, DK); fragmentation of science base (PL); disparities at both regional levels and in terms of the digital divide (HU); small number of high tech SMEs/spin-offs (SI, DK); too many SMEs (NO); few companies with R&D (ES)
- Human Resources: generally an issue (IE); research careers specifically unattractive (BE); brain drain (HU, LV, RO); low level of knowledge workers (NL, SI) and of academics (DK, SI); lack of qualified personnel in some domains (LV, CH); low mobility (SI); low entrepreneurial propensity of S&T graduates (EL); rigidity of labour market and training (EL); high personnel costs (LU)
- Funding limitations (especially public) and risk averseness (IL, HU, BE, SK, PL, CH, LV, DK, IE, UK, EL, BG, NL, RO, NO, ES, LT, PT, DK); low attractiveness for FDI (EL); global setbacks in the development of the venture capital markets (DE)
- Infrastructural limitations (HU, SK, PL, CH, LV, UK, IE, BG, RO, ES); long distance from research to market (BG); insufficient university industry links (BG, RO); insufficient exploitation of science results (NL); focus of regulatory environment (UK); small size of research and innovation system not linked to the needs of the business sector (ES)

- Lack of culture of creativity and of support for innovation (UK, PL, LV, SK, IE, EL, NL, SI); little understanding of role of R&D in growth (EL); lack of relevant government programmes (EL); low visibility within society (ES); insufficient public-private cooperation (PT, FR)
- Low absorptive capacity for technological innovation (LT, AT)
- Unfavourable external macroeconomic conditions (HU); low growth rate (DE).

Table A1 on the next page brings together the result of the main positive and negative factors affecting the attainment of higher R&D investment levels (Question **1.6**), the formulation and composition of the policy mix (**2.4**), the refocusing of public expenditure (Question **3.3**) and the process of redirecting State Aid (Question **5.3**).

This table is meant to make it easier to go through the questionnaires and to identify similar patterns of response in two or more countries.

For instance, priority setting is a positive factor when it concerns raising expenditure in R&D in three countries (BG, DK, NL), and in many more when the refocusing of public spend is considered. A lack of public support ("no culture of innovation") appears to go together with a low priority for raising R&D expenditure, but the same does not apply to the shifting of other expenditure to R&D. One possible interpretation is that the inclination to give up budgetary discipline for the sake of research and innovation is low among policymakers.

Another example of a similarity that may be investigated further by going back to the detailed responses to the questionnaire is that between HU and SI, which cross many of the same boxes. However, unlike HU, SI does not seem to consider its economic structure to be unfavourable to R&D and innovation and finds its public sector research concentrate too much on basic research and too little on technologically advanced applications.

Table A1 Main positive and negative factors affecting the attainment of higher R&D investment levels (Question **1.6**), the formulation and composition of the policy mix (**2.4**), the refocusing of public expenditure (**3.3**) or the process of redirecting State Aid (**5.3**); only the first entry is ticked in the case of multiple occurrences

	BE	BG	DK	DE	EL	ES	FR	HU	IE	IT	LV	LT	LU	NL	AT	PL	PT	RO	SK	SI	FI	SE	UK	CH	IL	NO
Positive factors																										
Priority setting		1.6	1.6	3.3	3.3	3.3		3.3	3.3					1.6				3.3		3.3		3.3	3.3	3.3	3.3	1.6
Strong government commitment	2.4	5.3	2.4		5.3	2.4	2.4	2.4	2.4			5.3	2.4	2.4						2.4		2.4		2.4		
Strength of public sector research base	1.6	1.6				1.6	1.6	1.6		1.6	1.6			1.6		1.6	1.6		1.6							1.6
Research in specific sectors/companies	1.6		1.6	1.6	1.6		1.6	1.6						1.6			1.6			1.6	1.6			1.6		
European influence (FPs, 3%)		1.6			2.4	3.3	1.6	2.4				1.6					1.6	1.6	1.6	3.3						
Legislation, including on State Aid		1.6			5.3	5.3		5.3					1.6						5.3	5.3						
Availability of funding	1.6													1.6			1.6			1.6		1.6			1.6	
Macroeconomic stability		1.6										1.6	1.6		1.6						1.6					
Human resources			1.6											1.6			1.6									1.6
Negative factors																										
Funding limitations, budget constraints	1.6	1.6	1.6		1.6	1.6		1.6	1.6	1.6	1.6	1.6	3.3	1.6		1.6	1.6	1.6	1.6	5.3	2.4		1.6	1.6	1.6	1.6
No culture of innovation					1.6	1.6	1.6	2.4	1.6	1.6	1.6	3.3	1.6			1.6	1.6			1.6			1.6		3.3	
Unfavourable economic structure			1.6	3.3	2.4	2.4		3.3		1.6		2.4				3.3	3.3		2.4		1.6					1.6
Lack of specific human resources	1.6		1.6		1.6			1.6	1.6		1.6		1.6	1.6				1.6		1.6				1.6		
Concentration of industrial research	1.6		1.6			1.6				1.6						1.6				1.6		1.6				
Macroeconomic situation				1.6				1.6	3.3								3.3	3.3							3.3	
Lack of coordination between main actors	2.4																	2.4	2.4		2.4			2.4	2.4	
Fragmented science base, no spin-off			1.6					1.6								1.6										

2. Design Policy Mixes and Optimise Financing Instruments

General remarks on the availability and quality of the information provided

The level of detail provided in the questionnaires varies according to countries, some providing exhaustive and precise information for all questions (such as the Irish, Hungarian or Dutch questionnaires) others being very sketchy with many incomplete responses.

Some reports are purely descriptive, while others provide some qualitative assessment of the situation with regard to RTD policymaking. Implementation of the OMC would perhaps require a more critical approach, which would make it easier to create the necessary dialogue for trans-national policy learning.

Some respondents focus on a narrow « science policy » area, while some others are broadening it to include framework conditions such as competition policy.

The quality and depth of the information would need to be more equal if the OMC is to improve R&D policymaking.

2.1 What policy mix is in place and how has it developed over time?
Please describe in terms of the range and nature of R&D and Innovation Policy Measures and Framework Conditions and Policies affecting R&D investment, the broad objectives of the different types of instrument, and the evolution over time of the relative balance between different types of instrument. Some indication of future priorities would also be useful. For examples of the different types of R&D and Innovation Policy Measures and Framework Conditions and Policies, please see Exhibits 1 and 2.

There are two different questions under 2.1. The respondents are asked to provide:

- a description of all policy action lines in place;
- a thorough analysis of the shifts taking place between various policy areas over time.

IE, DK, EL, RO and SK provide a rather exhaustive description of the policy mix. The other ones are more limited or even almost non-existent, and sometimes biased (e.g. BE: public research side and federal level, IL: company R&D). ***It would seem more efficient here to ask a single expert to write comparable information sheets on the policy mixes, using the information provided in response to this Questionnaire and other information that is already available***: Innovation Trendchart country reports (referred to by DE and NL); and OECD STI Outlook being the most comprehensive, comparable and up-to-date sources.

A large number of policy measures –and a very heterogeneous set across countries– are in place, but little information is given about trends. In a number of cases there are significant changes in the focus of R&D policies: greater emphasis on support of basic research (BE) and on indirect fiscal measures (HU, UK, PT), towards approaches emphasising general framework conditions (NO, DE). Some respondents (HU, LV) fear that the measures will lack the necessary critical mass on the national level to be fully effective.

Concerning the second question of ***broad policy shifts***, we do not get systematic information, notably because of the following difficulties:

- Answering this question requests a degree of awareness of the share of the policy mixes as a whole, and this awareness is deficient in numerous countries where the governance of R&D&I policy is split between various Ministries and Agencies;

- For Belgium and Switzerland, two federal countries, it is obviously difficult to gather this information from various authorities, each dealing with a part of the policy mix. The former report focuses on federal competencies only, while the latter does not detail instruments and mixes in place and does not indicate the direction of policy shifts. A fragmented policy landscape in federal countries does probably constitute a hindrance to the development of a holistic view on the R&D&I policy mix;
- Policy shifts are difficult to identify in the new Member States, since policies are put in place recently.

The only questionnaire in which we find a detailed analysis of broad policy shifts in R&D&I is that returned from the UK.

The most common ***policy shifts*** mentioned in the responses are[14] :

- Major driving force towards reinforcement of industry-science relationships
- Increased attention to research with technological objective (BE, SI, LT, NO)
- More competitive funding to universities (BE) and research institutions (LT)
- Creation of excellence poles, critical mass in research (LU, SI,)
- Reform of university institutional framework (DK, LT)
- Inclusion of concerns on R&D and innovation in industrial policy (IE)
- Reinforcement of public research funding (BE, IE, LU, NO)
- Shift from direct measures towards framework conditions (NO, HU, NL)
- Setting-up of reinforcement of tax incentives for company R&D (EL, ES, LT, NO)
- More attention to efficiency of government support and the governance of policy (UK, NL, NO)
- Development of a broader policy perspective, including concerns with the role of entrepreneurship, procurement, regulations, etc.) into R&D policy thinking (UK, SI, NL)
- Integration of education, research and innovation policy (NL)
- Increased attention to new technology based firms and start-ups, notably through provision of risk capital (SI, PT, NL).

An important driving force of the policy mixes consists of the European Regional Development Funds programmes for countries that benefit most from them (EL, PT). In those countries the policy mix is almost fully contained in the Community Support Framework and Operational Programmes.

Some country-specific responses on the change of focus of R&D support

- IE – ongoing change in the direction of industrial policy to support innovation and R&D and increase the flow of applied research from third level institutions, which reflect the increased commitment to increase the competitiveness of Irish industry
- SE – change from curiosity-driven research funded through university block grants to development of an efficient innovation system (systemic approach of innovation) and funding of mission oriented research.
- UK – direct measures have increasingly focused on changing behaviour or encouraging greater networking rather than providing grants to single firms. Post 1997, the Government has increasingly focused its attention on improving framework conditions particularly to increase entrepreneurship and improve the effectiveness of competition policy.

[14]Countries listed after each item do not represent the range of countries sharing the indicated policy focus, but only a sample gathered from the questionnaires' responses.

- DK– key objectives are enhancing system efficiency and networking by finding new ways of interaction between research and industry e.g. setting up joint knowledge networks; regional research projects, innovation consortiums; reform of research advisory system, university reform, law reform on government research institutions, act on technology and innovation, new act on technology transfer
- EL – until 2001 main focus on the mixes of project and institutional based funding of public R&D institutes, more indirect measures have been adopted since 2002.
- NL – streamlining the innovation policy mixes from 30 instruments to 6 and more integrated approach for education, research and innovation policy.
- PT – high priority given to programs for training high qualified human resources.

2.2 There are many ways of increasing <u>private sector</u> R&D investment levels … indicate which types of policy measures are being used in your country and the ways in which they are intended to influence private sector R&D levels

For reasons mentioned in section 1 above, it seems inopportune for a sound analysis to undertake quantitative examination of the responses gathered through the tables proposed in section 2.2[15]. In fact, the validity of the marks (from 1 to 5) heavily depends on the way the questionnaire was completed. (See discussion under question 2.3 below.) It is no coincidence that two countries which have developed more efforts in this direction, have chosen not to provide 1-5 marks (UK and Norway).

A very tentative check on the tables provided by the countries reveals that:

- Framework conditions are considered relevant to impact on private R&D investments, but less so than the range of R&D and innovation policies *stricto sensu*;
- Direct financial schemes seem to be more relevant to indirect schemes;
- Infrastructure is more important in candidate countries than in EU countries;
- Candidate countries tick more elements of the policy mixes as relevant than EU countries;
- Information and brokerage schemes seem important elements of the mix, besides the more classical instruments;
- Creation of R&D intensive SMEs seems to be an important objective of policies throughout the sample.

2.3 Who are the main institutional actors involved in formulating and implementing the national policy mixes (especially the financing sub-set) and how do they interact? Which organisations were consulted in formulating the response to this questionnaire?

Depending on the scope of the concept of the R&D policy mix, a larger or smaller number of policy actors are considered relevant.

Generally speaking, several Ministries are entrusted with the development of various parts of the policy mix. Classical divisions are between a Ministry of Science and Education and a Ministry of Economic Affairs for the content of RDTI policy, but several countries (especially the new Member States) also mention the Ministry of Finance, which has a direct role concerning the tax incentive schemes and an indirect role regarding the size of the R&D&I public budget as a whole. Little information is available about their mode of

[15] In particular, the British (no numerical marks), Norwegian (idem), Belgian (incomplete), Bulgarian (incomplete) and Swedish (no response) questionnaires cannot be used for such an analysis.

interaction; the only horizontal body mentioned being the S&T Council in some countries (in Switzerland, the two Ministries work out a development plan in collaboration) or the Innovation Platform in the Netherlands. Inter-ministerial coordination groups are mentioned by Luxembourg and Norway. Interestingly, the Research Council of Norway combines the roles of Advisory body, Funding Agency and coordination in one institution. A lack of coordination between the various policy bodies is mentioned as a problem for Belgium and Hungary, while conversely, the Irish case suggests increasing coordination through centralisation of competencies in one Ministry and one main Agency (Forfas), partly as a result of the extensive national consultation around the 3% target.

In some countries Parliamentary committees (IL, RO, FR), State Committees (e.g. KBN in Poland) are the interfaces of research and other (economic and financial) policy fields and the respective ministries. In many new Member States, Academies of Sciences play a role in the formulation of the policy mixes (HU, SK, LV, LT, RO).

2.4 What are the most important factors influencing the formulation and composition of the policy mix? Please mention factors having a positive influence (e.g. strong government commitment to R&D and innovation) as well as those having a negative influence (e.g. lack of coordination between relevant government departments).

Positive factors:

- Strong commitment of the regional/national governments, supporting R&D as a priority field (BE, HU, SE, IE, CH, ES, SI, LU, FR), in several cases translated in White Papers or National Plans – Policy cohesion: innovation performance depends not just on how it performs on each individual element of the national innovation system, but how these separate elements interact. It is the cohesiveness of the NIS that matters for a successful innovation performance (IE). Structural Funds programmes, imposing some degree of coordination across ministries in the country (PT).
- European influence: utilisation of lessons, experiences, best practices and intergovernmental dialogue (HU, SK, RO, EL).
- Analytical studies of the National Innovation System (mentioned by UK, DE, NL). Need for partnership across all institutional elements of the national innovation system to ensure that the public investment in research is focused and underpins the development of the growth clusters (IE). Needs and capabilities of the national S&T system (ES). Expectations from recently formed innovation division (HU, LV).
- High degree of mobility and increased networking capacities of research personnel (EL).
- Clustering and reducing the number of policy instruments (NL).
- Cooperation with private sector (HU).

Negative factors:

- Budgetary constraints for governments appear as a main blocking factor: financial restrictions, short term priorities, public deficit, arbitrage between increased funding for R&D and other expenditures (e.g. health system, reduction of tax burden, etc.) (BE, IL, CH, SK, RO, NO, FI).
- Lack of coordination between different authorities and at different ministerial levels (i.e. financial and R&D policymaking institutions) (BE, PL, HU, SI, NO, PT, FI). Lack of capacity in governmental agency (LT).
- Low absorption capacity of economy (SK, LT, EL), weak structure of industry (SK, ES)
- Inadequate culture of innovation (HU).

2.5 What processes are in place to monitor and evaluate (a) the individual components of the mix; (b) the set of financing instruments; and (c) the performance of the mixes as a whole?

At this point in the questionnaires, it becomes clear that most countries, with the exceptions of the UK and the Netherlands (and to a certain degree Norway and Spain) share the Swiss view that "*there is no notion of a broad policy mix for R&D and innovation as presented in Exhibit 1*". In the preceding questions, the respondents have made an effort to list the policy instruments in place, but mostly for reasons other than from an explicit wish to create a balanced policy portfolio. From the responses to this question 2.5 on evaluation (and the following ones on relevance and re-design), it appears that in most cases the policy mix is in fact a rather abstract construct, not subject to policy action (while the individual components of the mixes are).

In the answer to question 2.5, several countries mention monitoring tools only (e.g. Poland), or deal with project rather than policy evaluation (e.g. Israel), or take systemic performance for policy performance (e.g. Germany). Some answers are too vague to decide if there are sound practices in place in this area (e.g. Belgium, Sweden). Several cases of individual programme evaluations are mentioned (e.g. Ireland, Switzerland; UK, Norway, the Netherlands, Germany, Greece), but policy mix assessment seems to be rare. Programmes supported from the Structural Funds benefit from the compulsory evaluations imposed by the EU (mentioned by Portugal), but it is not clear whether these evaluations can be considered as horizontal evaluations of the whole RDTI policy mix. One should also take into consideration the fact that evaluations are not always translated into policy-relevant options (e.g. in Greece there seems to be a gap between evaluations and policymaking).

Questionnaires providing a partial answer to the question of policy mix evaluation: the role of the Strategy Unit in charge of thematic assessments crossing over several programs (UK); the inter-ministerial horizontal evaluation of policy carried out in 2002, and subsequently every five years (NL); an integral monitoring and evaluation system of the whole RDTI plan (ES). The experience of Denmark, which asked OECD to carry out an evaluation of its University sector may also be mentioned, although it is not clear whether the evaluation focused on policy mixes.

2.6 Are efforts made to assess the appropriateness of the mix? If so, how is this done and what criteria are used?

In line with the answers to question 2.5c), most responses here are negative, non-existent or too vague. For most of the new Member States and the candidate countries "it is too soon"; Romania plans to tackle this question in a forthcoming national conference on the 3% target.

AT and UK are two countries which provide a positive response to this question: policy reviews are carried out for specific issues (e.g. on industry-science relationships) and these incorporate considerations on the policy mixes in place. In the Netherlands ex ante and ex post evaluation of policy instruments is built into law. The appropriateness of the policy mixes in France is put into question in each budgetary round, taking into account international technological developments.

In general there is no direct strategy to assess the appropriateness of the whole mix. The policy mixes are being evaluated in its separate parts but not as a whole:

- LV – Monitoring and evaluation are still underdeveloped without strictly defined procedures.
- HU – The usual method is to evaluate the appropriateness of the mix through macro-indicators: the mix is considered appropriate if it brings about the improvements of selected target indicators. The opinion of stakeholders (universities, private sector, etc.) is also regularly sought about the appropriateness of measures introduced by the government, usually through questionnaires developed by experts.
- IL – A comprehensive survey is carried out periodically by the Central Bureau of Statistics. The aims of this survey are: (1) To estimate the R&D expenditure for the Industrial sector; (2) To produce a series of data on R&D that will enable continuous evaluation of the growth potential generated by technological changes; (3) To provide the government, research institutions and other planning bodies with guiding tools and data for comparison with other countries.
- SK – To assess the appropriateness of the policy mix in Slovakia there is one crucial criterion, the criterion of efficiency of spending financial sources. It is necessary to analyse every action before submitting it to the government for approval on its positive or negative influence on: (i) improving the standard of living, (ii) reducing unemployment, and (iii) increasing regional development.
- EL – an attempt was made during the recently implemented technology foresight exercise.
- RO – Ministry of Education, Research and Youth intends to launch a wide analysis of the procedures needed for monitoring the implementation and achievements of specific policy measures.

2.7 Do the policies and policy formulation processes of other countries affect the composition and operation of your country's policy mix? If so, please describe how.

The tone of the answers to this question is: *"yes, in general terms"*, meaning that policymakers watch developments in other countries, but that there is no clear and direct relationships between the moves of other countries and the actions of the country concerned. In many cases *"this is a decentralised process which involves a variety of approaches"* (DE). Participation in OECD and EU multilateral activities or benchmarking exercises is mentioned by several countries, and even singled out as a "main driving force" for policy development in Lithuania. However several respondents note that specificities preclude a simple transfer of policies from one country to another.

A limited number of countries commission systematic benchmarking exercises comparing their policies with those of other countries (e.g. DE, NL).

There is some direct influence for specific schemes, such as Competence Centres (US influence mentioned by SE, HU, NO) or Technology Parks (mentioned for LV), but there is no indication that this concerns the development of the policy mix: most likely, this trend is limited to specific schemes only. This process of "policy development watch" seems more important for the new Member States than for the EU-15.

Lessons learned from experiences of other countries are of crucial importance. Small countries (LU, FI) are especially interested in the permanent search for good practices that might be applicable and beneficial to the country concerned. Some countries (CH, HU, UK) established a network of scientific attaches who are in charge of providing information about important developments abroad systematically.

The picture emerges of a spider web of bilateral and multilateral exchanges of information, primarily within Europe:

- participation in the process of mutual learning and sharing of information through the Open Method of Coordination for the 3% Action Plan (IE, RO)
- LT studies the examples of Scandinavian countries, Ireland and other small economies: LV mentions a great many, but not all other EU and non-EU countries by name
- SK: co-operation within Visegrad (CZ, HU, PL, SK) and also with SI
- in addition to EC information, OECD activities serve as a valuable and closely followed source of information (FI, FR, DE, NO, HU).

2.8 Do the policies and policy formulation processes of the European Union affect the composition and operation of your country's policy mix? If so, please describe how.

Policy moves at EU level definitely influence policy-making in most European countries, most clearly in the new Member States and in those Member States that are heavily supported by the ERDF (European Regional Development Fund).

One important influence is the EU RTD Framework programme, more particularly its definition of R&D areas. The selection of Centres of Excellence within the EU is an important driving force for the creation of critical masses of research at the national level. However, EL and FR note that the possible synergies between the two types of funding are not fully exploitable.

The Barcelona objectives constitute the second driving force, which helps create/maintain the policy momentum for R&D. For new Member States, this influence takes place in the framework of the required adaptation of the regulatory framework to EU standards. NL considers the 3% target as an input target and is more concerned with the outputs resulting from R&D efforts.

The need to incorporate a growing R&D dimension in ERDF programmes is an important push factor in cohesion countries and the new member states.

One exception is the German response, stating that EU influence is mainly visible in the creation of framework conditions and not in the policy process (DE). SE emphasises the influence on EU policymaking from the national to the EU level. The Swedish influence is exemplified by the creation of agencies.

Some responses of particular countries:

- HU – It is not just that the idea of the European Research Area has been taken on board, but that it has been made an integral part of the thinking on policy making; a conscious effort is made to harmonise Hungarian and European policies.
- CH – not to duplicate what is already done at the European level and to adopt best practices.
- UK – EU policies relying on implementation at the national level may have a more direct bearing on domestic decision making.
- EL – about a quarter of the Greek GERD comes from EU Framework Programmes and Structural Funds
- FR – role of European Investment Bank and European Investment Fund
- RO – visit of Mr Busquin in February 2004 had a high impact on the promotion and integration of research and innovation related policies.
- NO – a recently established tax deduction scheme was based on the arrangements in the Netherlands.

2.9 What steps are being taken to improve the design of your country's overall policy mix?

While the preceding answers showed a rather low concern for the design of suitable R&D policy mixes, this question about future perspectives generates more interest. Generally speaking, there seems to be a wish to introduce more "policy intelligence" in the design of R&D policies.

Actions include:

- Transnational policy learning and benchmarking against other countries (ES, EL, HU, IL, SI); undertaking policy reviews and benchmarking studies (UK, DE, EL)
- Consultations on the 3% action plan and RDTI policy (IE, HU)
- IE – Consideration is being given by the Government on how best to co-ordinate the national research and development programme. The challenge is to develop a cohesive research network that will have strong linkages with industry and with research activities taking place across Europe.
- HU – Design of the country's overall policy mixes is the main rationale for the currently ongoing reforms and new legislations. Apart from newly introduced policies and measures, the new institutional system (e.g. the separation of policymaking and grant management) will also strengthen policymaking capacities.
- LV – Initiatives are undertaken to achieve greater coherence between various policy documents; foreign experts used for evaluation.
- SI – Measures have been taken to improve the coordination of overall policy mixes within all concerned sectors.
- UK – has just published several policy reviews, which draw on views from a wide range of stakeholders, to improve innovation policies, including policy co-ordination
- SE – The government plans to put forward an innovation strategy later this year, with a focus on how R&D can contribute to growth to a higher extent, e g access risk capital, less government bureaucracy for SMEs, mobility issues.
- DK – The Government has recently proposed the establishment of a "Future Fund" ensuring high investments in prosperous high-tech areas.
- ES, IL – negotiations to increase the budgetary allocations to RTDI activities; evaluations.
- EL, HU, PL – technology foresight programme
- NL – streamlining the innovation policy measures from 30 to 6 and more integrated approach for education, research and innovation policy
- LU – creation of the interministerial working group on Barcelona targets to design an action with optimal policy mix.
- AT – The Austrian Council, set up in 2000, is charged with defining a long-term national RTD strategy and step-by-step monitoring.
- FR – In 2006 the higher education and research programme will be structured around objectives and performance indicators.

3. Refocus Public Spend

This section asks about the switching of funds from other budgetary categories to "knowledge-related" activities. There is a great deal of overlap with the responses on other sections, in particular 2 and 4.

3.1. There is little consensus to date concerning the definition of 'knowledge-related' activities. What activities funded by the public sector are currently considered in your country to be 'knowledge-related' (e.g. R&D, innovation, education, training etc.)?

Most of the countries refer back to the suggested categories;

General consensus for:

- R&D
- Higher education
- Innovation

Also mentioned are:

- Life-long learning; post-university training (BG, RO, HU, NL)
- Info-society activities (BU, HU, LV, SK, RO, NL)
- Active labour policies and human capital general development (HU, EL, SI)
- Public procurement (innovative, e-government) (NL, RO)
- Technology assessment (CH, LV, IE, RO, LT, PT)
- Intellectual property rights protection (RO, PT)
- Research infrastructure development policies (ES)
- Knowledge (know-how) transfer (e.g. FDI-related; between university and private companies) (HU, ES)

Activities considered as "knowledge-related" usually are specified as such in government documents, dedicated laws, or national strategies for development. Innovation is taken in its broadest sense and not necessarily tied down to technological change. The UK makes the interesting point that consensus and common definitions are mainly needed to make comparisons with other countries and raises questions on the inclusion of defence R&D and applications of medical science. Some countries suggest the use of the practical (but partial) OECD definitions (UK, LU, EL, NO). PT suggests the use of the Frascati manual. It is also interesting to point out that KRA in the new Member States and in the candidate countries generally covers a broader range of activities, connecting the usual "knowledge-related" items with information society issues and active labour market policies.

3.2 What steps, if any, have been taken in your country to refocus public spend towards knowledge-related activities in general and R&D and innovation in particular? What actions are planned for the future?
For example, have there been any national initiatives either to stimulate or to monitor the process of refocusing?

(a) Steps already taken

- Adoption and implementation of specific R&D and innovation national strategies or plans (ES, PT, NO, RO, LV, PL)
- Special dedicated funds created (DK, HU, IE, NL, SI – "Ad Futura" Fund for intellectual capital mobility)

- tax credits, by categories – SMEs, large companies (UK; note: universities as charities are exempt from tax)
- financial R&D support (HU, SK, BE, IE), such as financial support to companies applying R&D results obtained in publicly funded programmes (RO, LT) and to science parks (LT), awards system for high education and innovation related initiatives (LT)
- programme bidding (competition-based) R&D support (UK, CH, RO)
- Support given to information technology and technological innovation (HU, RO, SK, ES)
- Reform of R&D and education systems, pushing towards increased innovative capacity (UK, CH) and private-public partnership (NL)
- Decision power given to regions (decentralisation) (BE)
- "Auditing" of R&D producers (companies/institutes/organisations) (PL, CH, RO) and monitoring/benchmarking R&D activities (NO)

(b) Actions planned

- National Development Plans including R&D and innovation as priorities intended to be implemented (HU, LV, SK, PL, RO); White Paper (NO); Report on Research 2004 (DE)
- Higher education system reforms following Bologna decisions (process), linked to knowledge-related activities or directly R&D (UK, CH)
- To reach the 3% target, public expenditure on R&D investment is planned to be increased gradually (IE, BE, DK, SK, LV, NL, AT, FR, ES – with 10% per year)
- Number of companies with minimum scale R&D activities targeted to double (IE in answer to 1.5)
- Reducing direct support for R&D to enterprises; increasing indirect support (AT, FI)
- Support for creation of infrastructure for technology transfer from abroad to domestic economy or from public research to business sector (EL, RO), support for R&D in SMEs (RO)
- Reforms in the area of intellectual property rights (PT, RO)

3.3. What are the most important factors influencing the refocusing of public spend? Please mention factors having a positive influence as well as those having a negative influence.

(a) Positive factors

- Inclusion of knowledge-related activities (education, S&T or R&D, innovation, high tech sector promotion) among the national priorities for development (IE, SE, NL, UK, HU, RO, CH, IL, BU, EL, SI, ES, DE – Agenda 2010)
- Former record of very high economic growth can be an impetus to increased R&D spending (IE, SK, IL, ES)
- Increased competitiveness (quality) of proposals (bids) for R&D financing, in the case of existing competition among budget categories (UK, SK)
- Establishment of specialised institutions and instruments for promoting R&D ("Future Fund" and Research Advisory System in DK, National Technology Foresight exercise in IE, Science and Education Committee parliamentary body and Technology Policy

Council in HU, National Council for S&T Policies and National Council for Research Audit in RO)
- The need for domestic co-financing related to EU structural funds (HU)
- Increased public and media awareness for innovation and R&D issues (EL, ES, PT)
- The pursuit of EU pre-accession targets for candidate countries, including the need to converge to European Research Area standards and mechanisms (RO, LT)
- The establishment of the ERA framework, imposition of the Barcelona targets and of R&D benchmarking system (ES, SI)
- Political and public (also media) importance given to human capital development (HU, SK, RO)
- Increased labour force mobility in the R&D sectors (SK – mechanism not explained)
- Merging the research institutes into universities (DK)
- Export-oriented policy measures and policies for increasing competitiveness (product quality) (Norway) and export-led growth (NO, DE)
- Direct R&D and innovation policy measures taken by the Government (the Netherlands), such as public-private partnership enforcement (LU, NL, RO)
- EIB; 6th Framework Programme; Presidency of Eureka (FR).

(b) Negative factors

The three factors mentioned most often by respondents are:

- Budget constraints (BE, UK, HU, SK, CH, IL, NL, BG, RO, EL, ES)
- Macroeconomic pessimistic outlook (IE, HU, RO, IL, DE, PT)
- Weak public relations and public perception for the role of R&D in socio-economic development (HU, LV, IL, EL, LT)

The following factors were mentioned by some respondents and are either characteristic for candidate countries (poor R&D infrastructure inherited from the past), or a consequence of economic development (higher labour costs inducing a slow down in FDI inflows)

- Decentralisation of public R&D financing system (CH; regional decision by Canton)
- Weak R&D infrastructure and absorption capacity (HU, PL, ES)
- Stability Pact criteria (LU, ES)
- High labour costs or relative production costs (NO)
- Weak performance of the small business sector due to low financial opportunities (PT, DE)
- Decline in motivation of foreign investors to spend in local R&D (augmenting labour costs) (IE)
- Negative overall attitude towards R&D and innovation in society (FI)
- Low level of funding by foundations and other non-governmental organisations (FR)

3.4. Where will funds for any expansion of knowledge-related activities come from?

The answers to this question most often do not refer back to the delineation of knowledge related activities (with the exceptions of the Netherlands and the UK), but relate to the financing of direct and indirect measures to reach the 3% target on R&D expenditure. They are formulated in terms of budgetary trends rather than specific policy decisions. Consequently, there is a huge overlap with previous sections of the Questionnaire and with the next section.

For the purposes of Section 4 the Irish response is exemplary and very comprehensive. It calculates the public budget requirements and the additional funding needed from industry and other private sources in three scenarios on economic growth (IE).

The State (public expenditure) and private sector entities (domestic companies, foreign-owned companies, foundations and non-profit organisations) appear in many different configurations as sources of finance in the other responses:

- Only the State (SI); from the federal budget and the Austrian National Bank for the newly established National Research Foundation (AT)
- Direct measures within the specific budget expenditure category (DK, HU, PL, RO, NL, SK, IL, EL, SI, NO, ES, FI). In some cases, special funds have been created; they can be effective if there are no serious budget constraints; in the case of new member states, budget restrictions apply, thus implementation and efficiency of funds is weak/low. Also, there are countries mentioning a diversification of KRA budget portfolio (EL).
- Cut-backs from other budget categories (education – SK; health – CH; subsidies to industry – UK, HU)
- EU budget for R&D (structural funds, EU Framework Programmes, "European Research Fund" of 2 billion euro per year) (DK, LV, PL, RO, EL, NO, FI) or other R&D international financing organisations (RO)
- Cuts in operational costs of public administration (HU) and R&D project management (PL)
- Private placements and industrial funds for R&D (DE, FI, LT, SK, PL, IL – Stock Exchange, IE – from retained earnings, LV – in relation to FDI, RO) or re-locations of R&D activities by multi-nationals (ES)
- Enforcement of complementary funding of R&D (additional resources from education budget, Private Funds, external collaboration, etc.) (NL, RO, LT, DE)
- Venture capital funds (IL, PL, ES, EL)
- Emphasis on private funding, fostering donations and finding an appropriate status for foundations (FR).

4. Public Budget Needs

Governments can increase R&D expenditure by increasing their own spending in the public sector, increasing the direct public funding of the private sector and by indirect measures stimulating R&D in the public and private sector.

The 3% of GDP target for R&D expenditure implies a benchmark of 1% of GDP for public research spending. However, in a small number of countries the definition of the R&D targets involves serious estimates of the additional public funding requirements, either to be transferred to the public research performers or to the private companies through direct and indirect measures. The impact on the government budget of direct and indirect measures (tax credits, for instance) should typically be taken into account. R&D investment is expected to have positive effects on growth and competitiveness, which with time will have positive effects on the budgetary situation of the government.

Generally, public budgeting in favour of R&D much depends on public/policy awareness of its importance. The levels of public funding for R&D are subject to regular budgetary negotiations within the government. Budgetary procedures may differ between countries, but

they usually are a combination of top-down priority settings and bottom-up budgetary claims by department, with spending constraints imposed by the Ministry of Finance's treasury function. Forecasts of GDP and other economic variables are part of most multi-annual budget setting procedures. Few respondents refer explicitly to such procedures. There are techniques to estimate budget needs and perspectives, but the unclear issue is how the gap between requests and overall budget availability is bridged.

4.1 What processes and tools are used to estimate your public budget requirements for measures related to the raising of R&D investment levels?
Please note that public budget requirements cover public spend on R&D plus spend on measures designed to raise private sector R&D investment levels.

In relation to this question it is important to know how much priority is given to R&D in the policy context and which countries have set up explicit "quantitative R&D targets" with respect to the 3% objective. Some of the relevant information can also be found in other parts of questionnaires (e.g. question 1.5).

The question on how to estimate the public budget requirements to reach the target R&D investment levels in the public and private sectors is approached in different ways:

- Some countries (UK, NL) use specific tools for estimating future public budget requirements for increasing R&D expenditures. They also tend to make greater use of evaluation procedures. This is for instance the case in DK, where a specific Annual Report is issued since August 2003. PL mentions a "National Foresight Programme" which defines priority areas of S&T (but it is not clear whether there are financial estimates included).
- RO gives a concise, complete and accurate account of the public budget planning process, through multi-annual plans, annual revision of priorities, determination of the level of public expenditures and identification of financing sources (public, private, foreign). The multi-annual budget projection includes a positive trend in R&D expenditures in enterprises through increased participation in the National Plan for R&D and Innovation and EU Framework Programmes. Romania also relies on a 4-years multi-annual planning and the revision of priorities based on previous results. This country has a National 3% Action Plan in which the necessary budgetary resources are evaluated.
- Several countries (ES, EL, HU, IL, NO, PT, SI, AT) describe their budgetary process as starting from the needs of the research community, based on surveys (ES, IL, PT) or on information from Research Councils and Innovation Platforms (NO, FI). FR collects data on aid to industrial sectors and SMEs. There is a top-down and bottom-up process in which the main tools (for the majority of them) are surveys or administrative procedures to estimate absorption capacities of the R&D performing target groups, to estimate needs and demands (IL) or targeted to ministries and PRCs (PT).
- There is a third subset of countries which do not refer to specific tools but to policy processes which are basically top-down (SE) or involve a series of consultations with stakeholders about their requests. The latter is the case in BE and CH, where the existence of autonomous regions introduces complexity in the processes. In the Spanish case the national and regional budgeting process are structurally independent (ES).
- Finally, in EL, LV, LT and SK, there is not a clear process for estimating future public budget requirements on R&D associated to R&D policy targets. In the Greek case, budget increases are reported to be made according to inflation and only a small differential relates to the priority of national needs. In Latvia, the lack of specific tools is explained by the context of stagnation of national investment, and in Lithuania by the absence of changes in the R&D budget over the last decade. In Slovakia a strong emphasis is put on co-ordination with other policies, and very specially, on socio-economic effects of funded research.

4.2 In assessing future public budget requirements, what consideration is paid to the balance between national and Community levels of expenditure?

Generally speaking, in assessing future requirements to increasing R&D spending, very little or no consideration is given to the balance between EU and national funding by a large group of respondents. The exceptions are HU, PL, RO, UK and DK. The first three mention the fact that the balance between EU and national funds depends strongly on national efforts to improve framework conditions. In order to compete for EU funds a sufficiently developed national R&D system is needed to match those funds.

Specific remarks from the countries approaching the question from the angle of EU pre-accession (RO) and structural funds

- HU: the more EU funding drawn to the country the better, and the more national expenditure on R&D
- PL stresses the same point by stating that the more EU funding is directed towards R&D the more matching funds (co-financing) will need to be secured by their government
- LT lists the EU objectives that are reflected in its "National Multi-annual (2003-2015) Action Plan for R&D Strategy" and recommended in the World bank report "Lithuania: Aiming for a Knowledge Economy", but states that up to now new policy measures for achieving the strategic objectives have not been taken.

Countries with less specific aims

- Adapt to trends and measures at Community level (BG)
- Increase participation in R&D Framework Programmes (ES, RO with Phare support; cf. SE response to 4.3)

Net contributors to the EU budget seem to qualify the use of structural funds

- UK: the balance should be determined by additionality
- NL: generic tools for R&D funding; specific tools for EU development

The National Development Plan serves as Ireland's government investment programme for the period 2000-2006. The Community Support Framework is the subset of measures within the NDP, which are co-financed by the EU Structural Funds. The CSF covers all the EU Structural Fund payments to Ireland, except for schemes that are part of the Common Agricultural Policy. The bulk of the expenditure under the NDP is not co-financed by the EU.

4.3 Are EU and national funds generally complementary or duplicative? Please describe the situation in your country.
For example, are national and Community funds used to finance the same or very different types of R&D-related activity, e.g. basic versus applied research; national programmes versus regional initiatives; sectoral support versus more horizontal measures, etc?

Few responses recognise the difference between funding through the Framework Programme and the co-financing of national expenditure through the use of Structural Funds, which by its very nature is complementary. The issue of additionality (with "crowding out of investment" as the negative, i.e. would the same amount of national funding have been used for the same purpose in the absence of EU funding?) is addressed explicitly in the Dutch response. The Finnish response states that R&D presently financed by the EU would probably also be financed if only national funding was available, but national financing of R&D and innovation has not decreased because of EU funding.

Perhaps the way the question is posed has led to a misunderstanding by some of the respondents. Apparently the question refers only to EU (competitive RTD) funds under the Framework Programme. However, in some countries significant amounts of EU (structural) funds are used as "financial instrument" to implement national or regional R&D policies. In addition, depending on the approach the funds could be simultaneously "complementary" and "duplicative" because the EU funding complements (increases) the funds available for performing actors while the EU and national funds are duplicative because they address similar type of "research priorities" and types of R&D related activities.

- It is difficult to ascertain whether respondents refer to programmes, tools, or types of research funded. For example, although Slovakia reports complementarity, the respondent understood complementarity had to do with the combination of public and private sources of financing in the implementation of either FP projects or projects from the National R&D Programs.
- EU funding is reported to be "complementary" in IE, CH, DK, DE, UK, SE, SI, EL, PT, NL, BG and RO. The first two countries report that EU and national funds are generally complementary as regards types of research; in addition in IE and CH, national funding concentrates on basic research (with a very special attention to the strategic areas of ICT and Biotech in the Irish case) whereas EU funding focuses on applied research. EU funds are complementary to Danish funds, and go to the same type of activities provided they have an international collaboration dimension. The UK highlights a high degree of complementarity between EU and national funds, which is however not related to types of research but based on the idea of "adding value" from EU intervention (e.g. mobility, transnational R&D co-operation, etc.). BG, ES, LV, LT, NL and RO stress the similarity of thematic priorities of the EU and national programmes, and Romania interprets complementarity as national co-financing of winning projects contracted with the Commission. The Netherlands reports the absence, at the national level, of special funds for research infrastructures and mobility, areas where EU funds are seen as important. SE, SI and EL also reported complementarity but without giving more details about the destination of funds. In PT a wider spectrum of fields is covered by domestic programmes than by EU funds. NL allows for additional funding from national sources when a project is linked to an EU programme (BSIK – fund for investments in specific research areas with a societal impact) and uses specific tools for EU thematic priorities
- In another large subset of countries, EU funds can be both duplicative and complementary. This is the case in HU, PL, LV, LT, IL, NO and BE. In the first three (new) Member States, EU funds are reported to be complementary in funding and duplicative in research fields (as one can interpret from the answers). In Lithuania, EU funds are duplicative with respect to research priorities. In Hungary there is the perception that duplication in funding –as financial instrument– is very unlikely to occur due to large differences in the order of magnitude with the "funding needs" of the R&D actors, and this might apply to other countries too. In Latvia the fact that there are both– complementarity and duplication– seems to be due to a strong dependence of the national system on aggregate investment, because now EU funds make half of total R&D funding in this country.
- In general, countries making little use of structural funds but exploiting the FP generally interpret complementarity as European added value, whereas countries making extensive use of structural funds interpret complementarity in terms of co-funding of R&D activities. ES uses structural funds to build research facilities in Objective 1 and 2 regions and also to co-finance R&D projects under the National R&D Plan.
- What the diverse interpretation of the responses in term of the financial complementarity brings us corresponds with the diverse implications, in terms of policy process, of the EU funds allocated for R&D activities. While the EU

Framework Programme funds are allocated directly, under the policy frames of the EU and research priorities, to the research actors, the EU structural funds used for funding R&D activities are allocated, in association with national funds, in policy processes determined by national decisions and, in that way, embedded into the national or regional priorities.

4.4 Are there any gaps in the funding of particular types of R&D activity that would be best addressed by initiatives at the level of the EU? If so, please describe them.

In this section the answers express a combination of, mainly, the normative models that respondents have about the role of the EU funding in RTD activities (subsidiarity model) and the preferences they have about the specific problems identified in their own countries.

- Generally, the responses to the question about the gaps in the funding of particular types of R&D activities that would be best addressed by the EU emphasise the European perspective, and also activities that are unlikely to be the core of policies at the national level due to the large scale and cost of such activities.
- In a great many of the responding countries (CH, DK, ES, EL, HU, NL, NO, RO, SK) EU funds are seen as important for filling in gaps in investment on: large scale installations, raising European excellence in the global context, developing the basis for new technologies and strategic emerging areas, and human resources development and mobility.
- Within this common perspective, some countries emphasise the need for EU funds to fill in gaps in the promotion of European excellence in basic research (Ireland and Slovenia) and projects away from commercialisation (Hungary); other countries emphasise the need for loans for the market uptake of new technologies (NL, FI) or more generally the availability of venture capital and equity funds (Hungary and Latvia) especially for SMEs (according to the Netherlands that also highlights public-private co-operation).
- Portugal Spain, Israel and Slovakia mention the importance of investment on networking and co-ordination on the EU level, and both Slovakia and Greece emphasise the need for EU investment in the building, rebuilding and running of R&D infrastructures. This issue of raising levels of investment in R&D infrastructure in countries below the EU norm might also apply to some of the new Member States.
- Interestingly, Norway and Romania agree that the development of some public goods and services are better addressed at the EU level: environment, energy and health issues are mentioned.
- SE, PL, BG and BE gave no response to this question, the UK response is implicit in section 4.3, and the German one in section 4.2, where the role of EU funds in improving European global competitiveness is mentioned.

5. Redirect State Aid

Although the financial support from governments reported under State Aid has been falling rapidly in recent years, the total amount of €86 billion in 2001 (0.99% of GDP) in the EU-15 leaves ample room for a redirection to horizontal objectives such as research and development (Enlargement will add an estimated €4.8 billion). In November 2002 the Council adopted an "economic approach towards less and better State Aid". The State Aid Scoreboard shows that in 2001 already 71% of State Aid – outside the sectors of agriculture, fisheries and transport, which receive more than half – was directed towards objectives that do not favour particular firms or industrial sectors. The Member States report that 13% of State Aid other than to agriculture, fisheries and transport (mainly railways) goes to R&D. It

should be noted that Community support (co-financing) from the Structural Funds is not included in State Aid, even if national expenditure on regional objectives is included.

The responses to the Questionnaires all comply with the Council decision but there appears to be considerable confusion on what constitutes State Aid. This is understandable. State Aid to R&D is a relatively small and diminishing part of total government appropriations for R&D. Since there is now a block exemption from the notification of State aid for R&D in small and medium-sized enterprises – as there is for training and employment – any further redirection to R&D in SMEs is bound not to show up in the Scoreboard.

The position on State Aid in the new Member States and in the candidate countries is different. As part of the accession process they have introduced State Aid legislation in compliance with the *acquis communautaire*. At the same time they recognise the greater needs of State Aid for the implementation of rescue and restructuring plans. Their responses tend to focus on R&D programmes as part of the Community Support Frameworks.

Many respondents tend to mix up the concept of refocusing public spending towards R&D (Section 3) with refocusing State Aid. The information provided in Question 5 some times is not relevant to State Aid but merely repeats or is complementary to information provided in other sections of the questionnaire (especially in Sections 1 and 3). Some times there is also an inclination to answer Q 5.1 and 5.2 as if they were asking the same question. Overall, the information provided is more qualitative than quantitative, not always accurate and seldom complete.

From the analysis of the information, it is evident that for the time being there is a manifest difficulty to accurately evaluate how the redirection of State Aid affects public R&D investment, but also how much it influences the level of private spending. Nonetheless, there is a common agreement that the redirection of State Aid causes an increase of R&D investments in the private sector. Furthermore, the evaluation of the economic impact of this redirection is seen as to be further developed (uncertainty about the evaluation result has been expressed).

Overall, a positive tendency can be detected in the answers in that they seem to head towards designing or implementing State Aid schemes which address R&D programmes (and not only R&D aid to individual enterprises).

Not much information provided (with the exception of one or two countries) on future plans to re-direct Sate Aids. In this context, there is an interesting remark made by the Hungarian respondent which affirms that the onset of Structural Funds and domestic (co-financing) programmes or other upcoming resources are not expected to raise the share of R&D State Aid further. It would be interesting to know if this view is shared by other new Member States.

The most recurrent positive factor influencing **the process** of redirecting State Aid towards R&D that has been mentioned is the political will to shift resources towards a more successful knowledge intensity economy, especially towards training and education and RTD&I to help both the public and private sector perform better.

As far as the specific information that comes out of the three questions in this section, answers were mostly country-specific and rather than grouping and summarising them by subject/content the most telling answers are reported below.

5.1 Have there been any efforts within your country to redirect State Aid towards R&D? If so, please describe them.
N.B. See Article 87 of the Treaty for a description of the items covered by State Aid, and please note that State Aid for R&D is typically a sub-set of public spend on R&D. It is thus legitimate for the answers in this Section from those in Section 3 on the refocusing of public spend.

Some twenty countries provide information on this issue, but seven (CH, DE, IE, LV, PL, PT, SI) do not distinguish very clearly between the redirection of State Aid and other forms of refocusing public spend.

DK, ES, NL, UK are spending most of the State Aid – outside agriculture, fisheries and transport – on horizontal objectives and part of this on R&D; they reproduce the percentages of the State Aid Scoreboard. The percentages for the EU-15, some of which (BE, EL, IT, AT, FI) actually turn out to perform better than the countries just listed, can be found in http://europa.eu.int/comm/competition/state_aid/scoreboard/2003/en.pdf

These countries see little room for a further redirection towards R&D or have no plans to do so (UK). FR would like to attribute more R&D support to young and innovative SMEs without the obligation to notify this as State Aid. DK "Future Fond" is expected to raise public and stimulate private investment in R&D in selected high-tech areas (biotechnology, nanotechnology, ICT).

BG, LT, RO, SK answer the question by referring to the adoption of EU laws and regulations. The implementation of the EU laws is under preparation. Since they expect to be able to finance R&D and innovation under the Community Support Framework of the Structural Funds in the near future, HU, LT, PL, SK have no incentive to redirect State Aid. The Research and Technological Innovation Fund is expected to have a positive impact on private R&D expenditures in HU.

For information on percentages spend on horizontal objectives in the new member States and in the candidate countries see http://europa.eu.int/eur-lex/en/com/cnc/2002/com2002_0638en01.pdf

Moreover, In Poland State Aid to enterprises for R&D is granted mainly in the form of co-financing of goal-oriented projects. The budget allocated to such projects amounts to 6-7% of the overall State Aid resources (“means voted”).

Hungary qualifies as State Aid the direct R&D&I founds that have been significantly increased in recent years (refers also to Question 3.2). The share of R&D in total State Aid is 6.1% (2001 figure). In the long run an increase in the share of R&D in State Aid is expected.

In Latvia no particular effort to redirect State Aid funds towards R&D is made nor are particular redirection initiatives foreseen.

5.2 To what extent is the redirection of State Aid likely to affect public and private R&D investment levels?

Quantitative estimates of the impact on public and private R&D investment are not given for any of the countries. The redirection efforts highlighted in the answer to 5.1 are expected to have a positive impact, in particular on private investment levels.

Most of the respondents expect that an increase in State Aid leads to more private R&D investments.

UK – referring to Commission estimates – highlights the fact that if all UK State Aid were redirect towards R&D, then R&D would increase by € 2 billion (2001 figures).

DK points out that their shift from State Aid to manufacturing to horizontal objectives has considerably increased both public and private investments in research.

IE makes no clear distinction between the concept of refocusing public spending towards R&D (Section 3) and the refocusing of State Aid and repeats information already outlined in Question 1.5. The same applies to CH.

PL points out that their project-oriented programme (see in 5.1) and the programme to support SMEs will result in increased private investment in R&D.

HU expects that the "R&D+I Fund" will produce a strong positive impact on private R&D investments. It also emphasises that the effects of such funding should not only be measured in terms of GERD/BERD but also in terms of the quality of the national innovation system

FR states explicitly that tax credits for research are increasingly preferred over State Aid, which is supposed to have a leverage effect on the financing of R&D projects in industry by providing a form of guarantee to the banking sector.

5.3 What are the most important factors influencing the process? Please mention factors having a positive influence as well as those having a negative influence.

There are a number of countries (AT, BE, DE, LU, PL, SE, UK) which do not answer this last question. FI refers back to the answer to question 3.3; HU, RO do the same but add additional factors. RO: restructuring creates needs for State Aid other than for R&D and Innovation.

HU, SK and SI mention State Aid legislation as a positive factor. This notion (principle of competitiveness) is also implied by the responses of EL and ES.

DK, ES, LV and RO emphasise the positive role of national plans and recently adopted national innovation programmes. RO and LV add strong support of the private sector for government policy. Strong government commitment is explicitly mentioned as a positive factor by CH and LT, and more implicitly by BG and EL.

SI: increased awareness of the role of science and research.

DK: government has proposed a tax deduction scheme of 150% of the expenses on collaboration projects; all companies can deduct investments in public research institutes

IE makes a general remark on positive factors which influence the reshaping of policy mixes towards more R&D spending in their country rather than the refocusing of State Aid, e.g. strong political commitment to transforming the country into a knowledge-based economy.

On the other hand, LV sees the lack of parliamentary support for the R&D strategy as a negative factor. CH and SI mention the limitations of the State budget; LT the lack of co-ordination between departments and the poor variety of measures.

HU provides a very clear overview of the factors influencing the process, i.e.
- Effect of State Aid legislation constraining State Aid
- Impact of EU to create clean-cut domestic State Aid regulations
- Inadequate innovation culture of companies influencing absorption capacities of State Aid

- Strong support of private sector for government policy, especially for RTI Fund

6. Concluding remarks

There is a high level policy commitment – "in principle" – to the Barcelona target in the EU25: reaching this target is regarded as a vital step for raising the competitiveness of EU economies and the Member States acknowledge that this requires a broad shift of policy priorities towards more knowledge-based areas. The formal links between the EU objectives and national R&D strategies are clear in most cases: the Barcelona target acts as a point of reference and a device for raising awareness.

However, there is still a certain incongruity between this high level commitment and the details of national policymaking: the question of the right policy mix is on the agenda in only a few countries, and a quantitative assessment of the policy effects and budgetary implications is lacking in most countries.

The two sub-objectives (1% for public expenditure on R&D as a percentage of GDP and 2% for private expenditure) seem to get much less policy attention than the overall goal. This may be because of the difficulty to steer private investments in research, the lack of instruments to estimate the effects of policy changes (such as redirecting State Aid to R&D goals) on private investment, or more fundamentally because there is no common understanding about the relevance of the split.

The high-level policy commitment appears somewhat fragile, as budgetary implications of the strategic shift towards more knowledge-based activities are seldom cast in stone in multi-annual budgetary plans. Budgetary constraints, changing macro-economic conditions and conflicting priorities may undermine efforts to sustain the “3% momentum”.

The most visible policy shifts which are likely to impact on R&D spending are: introduction of R&D tax credit schemes, streamlining of policy instruments, establishing excellence centres or policy platforms, increased funding for basic research, reinforcing science-industry relationships and commercial exploitation of research. However, the extent to which such moves will contribute to reaching the ambitious R&D target and the refocusing of public spending is not demonstrated for most actions and programmes that are in place or being planned.

Pre-accession and regional funding are very important devices for the European authorities to help sustain the move. In countries and regions that are large beneficiaries of these funds, the actions which are supported are deeply embedded in national/regional priorities. The question is to what extent the EU could use such levers to redirect public spending towards more knowledge-based activities, while at the same time respecting the subsidiarity principle. The most relevant approach may have less to do with the content of the National Plans than with fostering strategic planning capabilities in national/regional administrations, developing an evaluation culture, and introducing more transparency and rigour in policymaking.

One way in which the OMC could help to exploit synergies and economies of scale is in the development of tools to analyse the dynamics at play: the monitoring of indicators, the use of evaluation methods and the carrying out of model-based impact studies. Although these are in effective use in a number of countries, there is scope for the use of common tools and exchanges of good practices in these areas, as well as the development and improvement of indicators and statistics for the knowledge economy. In addition, there is a need to demonstrate the economic and societal benefits of R&D investments. The “R&D” argument

is inevitably weaker in the mindset of many policymakers than employment, growth and competitiveness arguments.

EU funding through the R&D framework programmes is seen as complementary to national funding on the following grounds: the creation of critical masses of expertise and infrastructure, adding an international dimension, the fostering of human resources development through mobility and the opportunity to tackle issues of a supra-national nature (e.g. environment).

Fragmentation and duplication of policymaking, both horizontally, concerning ministries and areas of competence, and vertically between the national and regional levels, is a problem throughout the EU. To some extent this has affected the responses to the questionnaire. The OMC approach seems better suited to gather information on broad trends and policy design processes than to give an accurate overview of the policies affecting R&D that are in place. Some information collected (e.g. on this last point in section 2) should be made accessible in a more organised way and with more resources and guidance, e.g. as part of the Commission's ERAWATCH activities.

Useful links:
http://trendchart.cordis.lu/
http://www.cordis.lu/era/
http://europa.eu.int/comm/lisbon_strategy/index_en.html
http://europa.eu.int/comm/eurostat/structuralindicators
http://www.oecd.org/topic/0,2686,en_2649_34451_1_1_1_1_37417,00.html
http://ue.eu.int/emu/en/index.htm
http://europa.eu.int/eur-lex/en/com/cnc/2004/com2004_0101en02.pdf
http://europa.eu.int/comm/regional_policy/debate/forum_en.htm
http://europa.eu.int/comm/competition/citizen/citizen_stateaid_en.html
http://europa.eu.int/comm/competition/state_aid/scoreboard/analytical_section.html

Exhibit 1

R&D and Innovation Policy Measures and Framework Conditions and Policies Affecting Public and Private Sector Actors

R&D and Innovation Policy Types

Direct Financial Measures
Grants for Industrial R&D
Collaborative R&D
Public Procurement

Indirect Financial Measures
Volume Tax Measures
Incremental Tax Measures

Catalytic Financial Measures
Risk Capital Measures
Loan Guarantees
Equity Guarantees

Other Direct Measures
Information and Brokerage Schemes
Awareness Schemes
Networking Schemes
Co-location Schemes e.g. Science Parks

Framework Conditions and Policies

Public Research
University Research Funding
Infrastructure Support
Centres of Excellence

Human Resources
Increasing Numbers
Increasing Quality
Increasing Mobility

Entrepreneurship
Broad-based Promotion
Targeted Promotion

Intellectual property Rights
Community Patent
IPR regimes for Public Research Organisations
GMO and Software Patents

Standards and Regulations
Reduction of regulatory burden
Creation of Lead markets

Competition Policy
Favourable State Aid Rules
'Innovation-friendly' Decisions

Macroeconomic Conditions
Stable Growth
Availability of Capital
Flexible Labour markets

Systemic Solutions
Technology Platforms
Cluster Policies

Source: Raising EU R&D Intensity: Improving the Effectiveness of the Mixes of Public Support Mechanisms for Private Sector Research and Development, Report to the European Commission by an Independent Expert Group, 2003

Exhibit 2 **Financial Mix**

Financial and Fiscal R&D Measures

Private sector R&D investment levels are affected by a variety of framework conditions and policies governing business behaviour generally and R&D and innovation activities in particular, but there is a specific interest in financial and fiscal measures affecting the private sector's access to, and use of, finance for R&D. These measures fall into the following three categories:

- **Direct Financial R&D Measures** involve the direct transfer of financial support for R&D from the public to the private sector via grants, conditional loans etc;
- **Indirect Fiscal R&D Measures** (often shortened to **Indirect or Fiscal Measures**) involve the public sector forsaking tax income from the private sector in exchange for approved R&D investment behaviour;
- **Catalytic Financial R&D Measures** are actions taken by the public sector that help R&D performers access external private sector sources of finance – which can then be used either to finance R&D directly or to generate profit, some of which will be re-invested in R&D. Typical Catalytic Measures are:
    - **Risk Capital Measures**, i.e. measures taken by the public sector that catalyse the flow and use of risk capital for both R&D and innovation-related activities likely to increase R&D investment levels in the future;
    - **Loan and Equity Guarantee Measures**, i.e. measures whereby the public sector tries to encourage additional investment in R&D by offering to share part of the risk involved in the provision of support for R&D and innovation-related activities.

Source: Raising EU R&D Intensity: Improving the Effectiveness of the Mixes of Public Support Mechanisms for Private Sector Research and Development, Report to the European Commission by an Independent Expert Group, 2003

Exhibit 3

STATE AID - Article 87 of the EC Treaty (ex Article 92)

1. Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the common market.

2. The following shall be compatible with the common market:

   (a) aid having a social character, granted to individual consumers, provided that such aid is granted without discrimination related to the origin of the products concerned;

   (b) aid to make good the damage caused by natural disasters or exceptional occurrences;

   (c) aid granted to the economy of certain areas of the Federal Republic of Germany affected by the division of Germany, insofar as such aid is required in order to compensate for the economic disadvantages caused by that division.

3. The following may be considered to be compatible with the common market:

   (a) aid to promote the economic development of areas where the standard of living is abnormally low or where there is serious underemployment;

   (b) aid to promote the execution of an important project of common European interest or to remedy a serious disturbance in the economy of a Member State;

   (c) aid to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest;

   (d) aid to promote culture and heritage conservation where such aid does not affect trading conditions and competition in the Community to an extent that is contrary to the common interest;

   (e) such other categories of aid as may be specified by decision of the Council acting by a qualified majority on a proposal from the Commission.

Way forward (3% Action Plan)

This framework for State Aid has been renewed in 2002 until 2005, and is not considered to be an obstacle to the achievement of the 3% target.

The Commission intends to amend the existing block exemption for SA to SMEs, widening the scope to both individual R&D aid and R&D aid programmes.

There is a main initiative to collect data and reporting on the direction of State Aid towards horizontal objectives, including research.