Private Sector Interaction in the Decision Making Processes of Public Research Policies

Study for the

European Commission
Research Directorate General
Directorate M – Investment in Research and links with other policies
Open coordination of research policies

Final report

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This report summarises the results of the study "Private Sector Interaction in the Decision Making Processes of Public Research Policies", carried out on behalf of the European Commission, Research Directorate General, Directorate M – Investment in Research and links with other policies, open coordination of research policies. As an input to the ongoing work in the context of the Open Method of Coordination (OMC) applied to the Barcelona 3% objective, it aims at providing a better understanding of how to improve Private Sector involvement in the decision processes of research policies, so as to achieve better use of investments in public research and a better leveraging of public funded research through a stimulation of increased privately funded research.

For this purpose, the study

- *describes the different forms of Private Sector involvement in the decision processes that instigate and shape the design, implementation and revision of research policies, framing publicly funded research in ERA and selected reference countries;*
- *identifies the "types" of Private Sector involvement in the countries under investigation, analyses their current use in each country and develops a cross-national comparative analysis and explanation of these "types";*
- *analyses through case studies examples of successful Private Sector involvement in the decision processes of specific research policy measures in ERA countries;*
- *identifies possible and existing barriers to an enhanced Private Sector involvement;*
- *summarises conclusions from the study results in recommendations to the different involved stakeholder groups how to improve Private Sector involvement in the decision processes of research policies and how best to stimulate increases in privately funded research through such a more effective involvement; and*
- *provides details on the current status in the countries under investigation in country profiles.*

The study was not designed for and does not aim at the provision of quantitative measures for the extent and impact of Private Sector involvement, as existing data and methodological frameworks do not yet permit this.

This report is based on the status in the countries under investigation at the delivery of its draft in April 2006, updates accounting for actual new developments were included until July 2006 where possible.

Executive summary

Importance and benefits of Private Sector involvement

Increased Private Sector research and development (R&D) investment and enhanced leverage from Public Sector research are crucial for achieving the 2002 Barcelona European Council's objective to raise European R&D investment to 3% of GDP by 2010. Despite this ambition, Private Sector funding of R&D in Europe has experienced a slow-down in recent years. To reinvigorate the original ambition, optimised conditions for business-financed R&D and subsequent innovation activities are an important prerequisite. This includes a wide range of research and innovation policy approaches to stimulate enhanced enterprise R&D and innovation activities, to improve relevant framework conditions and to strengthen the links between Public Sector research and Private Sector R&D.

The ways in which policies for this purpose are instigated, designed and implemented have changed fundamentally in the last decades. Research policy making has evolved from a traditional focus on ensuring sustained funding for research towards an integrated perspective of efficient governance of national science systems and of achieving leverage from research and its results. This implies a better co-ordination of research-related policy domains within governments, a higher degree of autonomy for research institutions and an enhanced involvement of the Private Sector and other stakeholders in research policy decision making.

As a consequence, the intensity of the interaction between Public and Private Sector is increasing. And its nature is also gradually changing from a 'linear' relation at specific opportunities to a more intense and complex, but also more sustainable form, where Private Sector contributions become an integrated element of research policy decision making. This is beneficial for both sides: The Private Sector's knowledge and perception, its expressed needs and recommendations add to the quality and to the successful implementation of research policies. At the same time, enhanced interaction in research policy issues helps to increase awareness of Private Sector enterprises and to stimulate their R&D investment, thus creating leverage for the achievement of the Lisbon and Barcelona goals.

The Private Sector contributes to all stages of research policy decision making

There is a widespread consensus among all stakeholders that Public Sector research policy decision making is the prime responsibility of policy makers. But as the prime 'absorber' of commercially relevant results of research, the Private Sector has an own interest to be involved appropriately in all phases of many research policy decisions. This encompasses

(1) the *instigation phase*, in which the Private Sector contributes to the identification of research priorities and of resulting policy needs, to the definition of research and policy objectives and to guidelines for the development of national science systems.
(2) the *design phase*, in which the Private Sector expresses its perceptions and needs to see them reflected in resulting research policy measures. At the same time, the Private Sector contributes also frequently in an advisory role to the definition of research policy measures and to the assessment of their feasibility and projected results;
(3) the *implementation phase*, in which the Private Sector as an important research performer and as a recipient of public research funds provides advice and feedback, for example to ministries and agencies which administrate research programmes;
(4) the *assessment and review phase*, in which research policy assessment instruments (e.g. evaluation studies) seek the feedback of all involved actors. If such an assessment leads to a research policy revision, Private Sector interaction can be re-intensified to ensure appropriate consideration of its needs in a next generation of research policy measures.

Chapter 1.4 lists and describes the research policy issues in which the Private Sector is involved frequently. In practice, such interactions are most common in research policy domains where both sides have a strong interest in the interaction and where the Private Sector can make valuable contributions, for example in applied research with high importance for tech-

nology-intensive sectors. However, according to our observations, a growing interest in Private Sector interaction emerges also in basic research, in service-related research in national research infrastructure and in educational and human resource-related issues.

Efficient Private Sector interaction requires dedication and a structured approach

An efficient and effective interaction does not 'happen naturally'. It must be instigated, shaped and maintained in a conscious effort on both sides. Private Sector actors must be aware of the benefits of being engaged in research and research policy and undertake dedicated efforts to express their perceptions, needs and proposals in research policy decision processes. Public Sector policy makers must understand the Private Sector's perceptions and needs, solicit and integrate its opinions and proposals and must be open for feedback.

This study identifies the approaches and instruments that are used for this purpose and it describes how these are currently applied. But there is no single instrument or a 'one fits all' approach which guarantees a successful interaction. Based on the criteria and determinants identified in this study, each national system must develop its own specific approach to involve its Private Sector in research policy decision making, depending on its overall and research policy objectives, its research governance framework and its economic environment.

Research policy decision making is not a purely rational process. Different views on how issues should be addressed compete for supremacy and different actors seek recognition of their policy proposals. Therefore, trustful relations, cooperative behaviour and a communication culture are indispensable. Therein, the Private Sector has a double role. On one hand, it can provide useful support as a neutral advisor. But at the same time, it is also a stakeholder, promoting its own interests. Accordingly, both sides should strive for a transparent and constructive interaction at an optimum level of intensity. 'More Private Sector involvement' does not automatically mean 'better decisions'. Policy makers must make a conscious choice to what extent they want to base their policy decisions on expressed Private Sector needs and/or policy proposals. This includes the maintenance of a sound balance between research for commercial use, the general advancement of knowledge and the provision of solutions for societal issues, e.g. in the health and environmental areas, as research targets.

A multitude of influencing factors and actors shape national 'interaction landscapes'

Current systems of Private Sector interaction have grown organically and vary considerably among ERA countries. Their intensity of interaction, applied approaches and instruments as well as the way in which these are applied in practice are determined by the overall national policy and governance frameworks, the structures of national science and innovation systems and underlying communication cultures. Interaction varies also by scientific disciplines (with a preference for natural, engineering and medical sciences of economic relevance), type of research, different time horizons and policy levels, by the type of policies and instruments used and the primary target group for Private Sector interaction.

Three important stakeholder groups shape this 'interaction landscape':

- *Public Sector*
  Political, administrative and intermediate institutions set the objectives and overarching framework for research policy. In particular, they define and implement specific research policy measures. To involve the Private Sector, they apply a variety of approaches, including a permanent dialogue and the soliciting of expertise and advice as inputs for policy making. The degree to which this has been implemented ranges from informal interaction to sophisticated institutionalised advisory and decision structures.
- *Research performers*
  Academic research and higher education institutions typically enjoy a high degree of autonomy to define their own research strategies. At this level, research policy decisions used to be taken exclusively by their academic boards (or equivalent). But in recent years there has been a growing tendency to open these processes for complementary external

knowledge, for example through external board members (including Private Sector representatives). Private Sector R&D has its own rich portfolio of links with Public Sector research institutions.

- *Private Sector*
  As a stakeholder, the Private Sector is represented on different levels in research policy decision processes. Typically, industry associations act as Private Sector 'spokesmen', consolidating the views of their members and expressing these vis-à-vis policy makers. But also individual enterprises or groups can take the initiative to get involved in research policy, for example if they have a particular interest in Public-Private-Partnerships. And individuals, typically high level representatives of important companies, act frequently as advisors to research policy decision makers, e.g. as members of advisory boards. In addition, in some countries charities and foundations play an important role through their funding of research or of 'think tanks' which issue own research policy concepts.

Over 30 approaches and instruments for Private Sector involvement identified

This study has identified over 30 different approaches and instruments for Private Sector interaction in research policy making. These can be grouped into four categories:

(1) Approaches and instruments to stimulate networking and general discussion promote relations between stakeholders, support the development of a continuous dialogue, mutual understanding and trust and help to identify evolving hot topics early. They include

- informal personal contact (ad hoc or regular)
- regular meetings
- mutual invitations
- conferences
- discussion platforms
- (thematic) networks
- staff mobility
- published information

(2) Approaches and instruments to create awareness, commitment and influence create awareness for the importance of research, research policy and interaction in this area, provide information as input for policy making, draw the other side's interest to research policy issues of (potential) importance, communicate own positions and help to understand the other side's position. They include

- awareness campaigns
- foresight exercises
- ad hoc meetings and workshops
- ad hoc studies
- position papers
- public statements (press conferences, articles, etc.)
- lobbying

(3) Approaches and instruments for providing advice to policy makers ensure that the Private Sector contributes in the desired way to the understanding of situation, possible implications and policy needs, the development of solutions and the creation of the necessary consensus to implement policy measures, once research policy instigation or definition are under way. They include

- ad-hoc consultations
- continuous consultative role
- internet consultations
- expertise
- ad hoc advisory groups
- individual advisory role
- advisory committees
- unsolicited advice
- 'think tanks'

(4) Approaches for research policy (co-)design, decision making and implementation go beyond the traditional role model where the Private Sector is limited to providing advice and opinions. They assume that the Private Sector takes an active stake in research policy instigation, formulation and implementation takes place. Often, this takes place if the

Public Sector and the Private Sector share the same objectives and a bundling of their competencies and resources leads to a 'win-win' for both sides. They include

- impact assessment
- steering committees
- evaluations
- board memberships
- policy task forces
- innovation platforms
- (operative) joint decision making
- delegated implementation
- operative support
- Private Sector research funding
- charitable foundations

Success factors for a multifaceted interaction process

Private Sector interaction in research policy decision making takes place on two levels. Most of the described instruments act on the *formal* level. They stimulate and support interaction, define the interaction space and provide a formalised framework for the exchange of opinions and for collaboration. However, there is no simple 1:1 relation in a sense that 'application of instrument A will yield interaction of type B', because in practice typical interaction situations are more complex. Often, the interaction is influenced by more than one instrument whose combined effects create unique interaction models. In addition, in many of the interviews undertaken in the course of this study, it became clear that even the best-designed formal interaction process will not come to life if it is not based on an equally important complementary *informal level*. Mutual trust and 'rules of the game' evolve over time and form an underlying, country-specific interaction culture which is determined by elements of national culture and historically grown behavioural patterns. Successful examples of Private Sector involvement combine both levels: Formal instruments, processes and structures ensure an efficient and result-oriented interaction. Shared values defined by an accepted interaction culture ensure the constructive attitude of all participants.

Based on these principles, we have identified the following success factors for Private Sector interaction in research policy decision making:

- The policy domain for interaction, the purpose and objectives of the interaction and its desired results must be transparent and shared by all parties involved.
- A supportive formal interaction context must be ensured by appropriate instruments and by their efficient application. Complementing this, there must be a basis of mutual trust, openness and willingness to contribute to constructive solutions.
- Dedication and commitment of both sides are indispensable. Efficient interaction takes place in the form of live (formal or informal meetings). Therefore, it must be a priority for decision makers on both sides.

Heterogeneous European interaction landscape

Today, all European countries recognise the importance of involving the Private Sector in research policy issues and use a wide and growing portfolio of approaches and instruments for this purpose. Informal contacts/consultations and conferences are the standard approaches to establish and maintain trustful, constructive relationships and to establish a continuous dialogue. To enhance awareness and commitment of actors, foresight studies and awareness campaigns also gain importance. For the instigation and design of research policies, almost all countries extend this general dialogue to an issue-oriented interaction, using most frequently for this purpose ad hoc consultations and studies, advisory bodies, formal consultations and position papers. In the implementation and assessment of research policies, interaction is ensured for example through membership in steering committees, evaluation studies and the (co-) funding of research by the Private Sector. Chapter 4 provides an overview over the use of specific instruments in ERA and selected reference countries.

But even if almost all countries use a portfolio of identified approaches and instruments in some form, today only the leading countries have a relatively consistent and efficient interac-

tion system in place. Other countries still are in the process of establishing the basic elements of the interaction processes and of getting the necessary commitment from all important actors. Three generic archetypes of national research systems can be identified:

(1) 'Forerunners'

Research-intensive countries with advanced Science and Innovation System government structures (especially some larger European economies as well as some smaller, highly research intensive, high-technology-oriented economies) tend to be also those where the Private Sector interface is most advanced. Typically, such countries have already sophisticated, well-established mechanisms for Private Sector involvement in place which are recognised and intensively used by policy makers and Private Sector stakeholders.

(2) 'Followers'

Countries with a medium technology and research intensity, including the most dynamic of the new member countries, have usually established already a basic awareness of and commitment to Private Sector involvement on both sides. And their first generation of interaction processes and mechanisms are in place. But to fully exploit their potential of this interaction, they need to further broaden and refine their Private Sector involvement, including the introduction of proven advanced concepts like sophisticated advisory and consultation approaches, cluster-oriented initiatives, etc.

(3) 'Beginners'

Countries which still need to accelerate the transition from traditional structures to a knowledge-based economy with a higher share of research and technology intensive sectors still face the challenge of fully establishing their first generation structures and processes for an efficient Private Sector interaction as part of a broader effort to build up modern research governance structures. Their focus is on creating awareness, gaining support and commitment for the development of this interaction, building a sustainable base of permanent contacts and interaction and establishing appropriate instruments.

Groups of countries with similar interaction patterns and transferability of instruments

Groups with similar or comparable patterns of Private Sector interaction in research policy decision making are identified on the basis of different criteria:

- *Science and Innovation System characteristics* (e.g. research intensity, innovation performance) provide also indications for the status of Private Sector interaction: Well-performing, highly dynamic systems, based on knowledge- and technology-intensive economic sectors, tend to have also efficient interaction systems in place. Large-scale Science and Innovation Systems ensure a critical mass of resources and enterprises committed to research policy involvement. But they are also more likely to encounter limitations imposed by the complexity of their research government systems.
- *Research governance systems* in European countries range from highly centralised to highly decentralised ones. In our research, we found that these different types of governance frameworks favour the development of different interaction models and encounter different types of barriers. But neither of them seems to be superior or inferior as a fertile ground for Private Sector involvement per se.
- The *"economic demography"* has also an important influence on the nature of the interaction. A high share of research- and technology-intensive economic sectors tends to foster intensive R&D collaboration and related research policy interaction. But if such an intensive interaction exists, it is often dominated by large enterprises. In many countries, SMEs are underrepresented in research policy decision processes. The high dependency of some European economies on foreign R&D investment can create further challenges.

For the assessment of the transferability of single instruments, it is important to bear in mind the limitations of such categorisations. There is no such thing as a 'one size fits all' solution, even among neighbour or comparable countries. Comparable characteristics of the National

Science and Innovation System, governance structures, etc. indicate in principle if a transfer of a specific instrument or the way how it is applied is potentially beneficial. But the ultimate success will depend on whether it fits into the unique combination of interaction approaches which each country has developed in its interaction practice and whether it is compatible with its specific formal and informal 'rules of the game'.

Existing and potential barriers limit effective and efficient Private Sector interaction

In recent years, continuous progress has been made in the involvement of the Private Sector in research policy decision making. But our analysis has also shown current limitations and a need for pushing the frontiers of this interaction further to maximise leverage from it for the benefit of both sides.

This study has identified four major types of existing or potential barriers:

(1) 'Intrinsic conflicts'
A "natural" mismatch in the expectations, objectives, strategies and behaviour stems from the fact that Private Sector actors are primarily oriented towards financial and market goals, while Public Sector policy makers have to balance economic, scientific, ecological and other societal objectives. Such 'intrinsic' conflicts include

- different objectives
- different time horizons and planning cycles
- incompatible decision processes
- ownership and confidentiality issues

(2) *Public Sector-specific barriers*
The Public Sector encompasses a multitude of actors, opinions and objectives itself. As a consequence, internal conflicts of interest between policy domains and inefficiencies can occur. Other barriers, stemming from the underlying administrative and political frameworks add to this. The following major barriers were identified:

- lack of commitment to enhance Private Sector involvement
- lack of appropriate indicators and feedback
- lack of comprehensive 'ownership'
- Public Sector-internal interdependencies
- fragmentation and complexity of administrative structures
- time-consuming and compromise-oriented decision processes

(3) Private Sector-specific barriers
A lack of awareness and of articulated interest in R&D and especially in research policy still limit the potential for a more intense research policy-related interaction in some sectors. This problem and the resulting need for more dedication to an efficient interaction range high among the identified Private Sector-specific barriers:

- awareness and recognition of research policy involvement as a priority
- conflicting corporate objectives and trade-offs
- unbalanced political power and participation in research policy making (e.g. SME under-representation)
- biases introduced by economic demography
- service sector gap
- partial need for further development of structures for Private Sector representation and internal alignment
- conflicts of interest between subgroups
- "polyphony'
- lack of incentives for a sustained commitment
- availability of key individuals

(4) Process, structural and cultural interaction barriers
In the zone of interaction, either side can take the lead in initiating the interaction, bringing it forward and providing the necessary platforms. Specific barriers can occur here:

- 'clash of cultures'
- hidden agendas and mismatch of expectations and attitudes
- lack of empowerment
- lack of support
- insufficient management of the interaction interface
- lack of experience
- inertia

In addition, Chapter 5.6 summarises specific barriers faced by the new member countries.

The occurrence of such barriers depends on the individual situation of countries, including the characteristics of historically grown research governance systems and underlying overall policy frameworks, economic structures, decision processes, socio-cultural background, etc. Not all of these can be influenced directly by research policy instruments, indirect measures or changes in behavioural patterns and communication culture.

Recommendations

This study confirms the importance of Private Sector involvement in Public Sector research policy decision making. For such an efficient interaction, well-designed processes, structures, mechanisms and instruments, a supportive environment and the commitment of policy makers and stakeholders are necessary. This leads to the following overall recommendations:

- *A strong dedication to effective and efficient Private Sector involvement in research policy decision making should be made an **integrated part of the governance of national science and innovation systems.***
  - *Research policy makers should invite and solicit **Private Sector interaction in their decision processes** for the enhancement of quality and acceptance of policy measures. They should identify research policy areas with a need for interaction, choose and implement appropriate instruments and ensure efficient internal decision processes and openness for Private Sector contributions.*
  - *Private Sector actors should develop a broad **awareness** of the need and benefits of being involved in research policy decision making, **identify priority research policy areas** where their involvement is crucial and allocate a sufficiently high **priority** to their active interaction in related decision processes. This includes both own initiatives and participation in Public Sector initiatives.*
- *In the design of this interaction, both sides should set **priorities** on policy areas where interaction is of particular importance, define **target level** and **target results of the interaction** and choose **approaches** and **instruments** accordingly. This includes **supportive framework conditions** and – where necessary – the enhancement of a mutually supportive and trustful **communication and collaboration culture**.*
- *To assess their current position and improvement potentials, both Public Sector and Private Sector actors should undertake – where appropriate – a thorough **review** of the current level, efficiency and achieved impact of their interaction in the research policy field. Depending on the outcome, they should define **priorities and improvement targets** for the enhancement of this interaction. This may include for example a streamlining of decision processes, the introduction of new instruments or a cultural change of an existing communication culture.*

When reviewing the current status of Private Sector interaction and choosing approaches for its development, policy makers and stakeholders should also be sensitive to the development stage of the science and innovation system and of its Private Sector interface.

Beyond these general recommendations, this study addresses specific improvement needs through recommendation for the involved groups of actors and stakeholders:

(1) Recommendations for policy makers

In their efforts to reform and develop research policy frameworks, Public Sector policy makers should put a special emphasis on the enhancement of processes, structures and instruments for involving the Private Sector. This includes the following fields of action:

- *Promote sustained and visible commitment to Private Sector involvement.*
- *Ensure "one face to the stakeholder".*
- *Apply a context-specific approach to involve the Private Sector.*
- *Mobilise a larger Private Sector base for active participation in research policy making.*
- *Safeguard a sane balance between different types of Private Sector participants in research policy-related interactions*
- *Build responsible and trustful relationships with the Private Sector.*
- *Enable seamless and transparent decision making with anchor points for Private Sector interaction.*
- *Develop dedicated approaches for Private Sector involvement.*
- *Stimulate enhanced interaction on the operative research level.*
- *Monitor status and progress achieved in Private Sector involvement.*
- *Avoid 'over-formalisation' and 'over-instrumentalisation' of the interaction.*
- *Balance economically oriented objectives with other research policy targets.*

As a general guideline for policy makers, Chapter 6.2.2 proposes a five step approach to choose depth and type of desired Private Sector involvement.

(2) Recommendations for the Private Sector

To further strengthen the Private Sector's growing engagement in Public Sector research policy decision making, the following measures are recommended:

- *Commit to research policy involvement.*
- *Apply a context-specific approach to research policy engagement.*
- *Mobilise a larger Private Sector base for active participation in research policy.*
- *Safeguard a balanced representation of the Private Sector in research policy-related interaction.*
- *Extend Private Sector involvement to less research intensive and service sectors.*
- *Speak with one voice.*
- *Build committed and trustful relationships with the Public Sector.*
- *Take the initiative and come up with own creative ideas in important areas.*

As a general guideline for Private Sector decision makers, Chapter 6.3.2 proposes a four step approach to choose depth and type of Private Sector engagement in research policy.

(3) Recommendations for the European Commission

The European Commission can support, for example under the OMC framework, the exchange of experiences and joint learning among the Member States in order to contribute to the development of the national Public and Private Sector interfaces. For this purpose, the following actions may be helpful:

- *Promote the concept of Private Sector interaction and encourage the exchange of experiences and joint learning.*
- *Establish a database of good practices and, where appropriate, quantitative and qualitative indicators and benchmarks.*
- *Work towards guiding principles for Member States, combined with possible path-ways for improving Private Sector interaction.*
- *Periodic monitoring, evaluation and peer review as a mutual learning process.*
- *Provide special support for new member and candidate countries.*

1. Introduction: The role of Private Sector interaction in Public Sector research policy decision making

1.1 Policy objective: Intensification of Private Sector research and innovation

In March 2000, the European Union set itself the ambitious goal to become, by 2010, "the most competitive and dynamic knowledge-based economy in the world" (known as the Lisbon strategy[1]). A key element of this strategy is to leverage investment in Research and Development (R&D). Therefore the 2002 Barcelona European Council has set the objective to raise overall European R&D investment to 3% of GDP by 2010. To reach this, research investment should grow at an average rate of 8% per year, shared between a 6% growth rate for public expenditure and a 9% growth rate for private investment[2].

A thorough review undertaken by the new Commission in 2005 has confirmed the 3% objective as a key element of Europe's 'knowledge and innovation for growth' approach. But it has also shown that most European countries need to intensify their current efforts to reach this goal. At present, Europe is lagging behind the US and Japan in both research and innovation. In 2004, the EU has spent nearly 200 billion Euro on Research and Development (R&D). But European R&D intensity[3] has stagnated at a level of approx. 1.90%, compared to 1.92% in 2003. In 2003, R&D expenditure was 2.59% in the United States, 3.15% in Japan and 1.31% in China. R&D expenditure in the European Union rose by 1.3% in real terms, compared to -0.1% in the US and +1.8% in Japan in the period between 2001 and 2003[4]. At this pace, the EU will not be able to meet its self-defined target to reach an investment level of 3% of GDP in R&D by 2010, even if there is a growing commitment in most Member States to increase the national research investment.

The *2005 European Industrial R&D Investment Scoreboard* (EC 2005a) confirms the overall stagnation trend. Even if, compared to the 2004 scoreboard, a slight increase (0.7%) of R&D investment by EU companies can be observed, non-EU companies continue to invest more and faster (6.9%), contributing to the increasing R&D gap. Individually, EU companies such as Daimler-Chrysler or Nokia performed as well as non-EU companies such as Microsoft and Toyota. But overall, EU companies are less present in highly R&D intensive sectors such as biotechnology, health and information technology and invest more in medium R&D intensive sectors such as automobiles. The report states also that the EU is weak in enabling SMEs to grow into large R&D investors, particularly in emerging R&D intensive sectors[5].

The quantity and quality of research results determine also the scientific base for the following conversion of scientific knowledge into new technologies and marketable products and services. According to the *European Innovation Scoreboard 2005* (EC 2005b), there is a similar gap in this innovation performance between Europe and its main global competitors[6]. The US and Japan are still far ahead of the EU average and the vast majority of Member

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1 The ways and means to achieve this objective were initially defined in 2002 in the Commission's communication *More research for Europe – Towards 3% of GDP* (EC 2002) and a following *Action Plan 'Investing in research'*, adopted in 2003 (EC 2003).

2 Assuming an average EU GDP growth rate of 2% per year until 2010; Source: *Action Plan 'Investing in research'* (EC 2003)

3 Investment as a % of GDP

4 Source of data: Eurostat 2005a

5 The Scoreboard focuses on companies' R&D investment, and is intended to complement, rather than replace, the "territorially specific" data collected by national or international statistical agencies. The main difference lies in the data provided. The *Scoreboard* refers to all R&D financed by a particular company from its own funds, regardless of where that R&D activity is performed. BERD refers to all R&D activities performed by businesses within a particular sector and territory, regardless of the location of the business's headquarters, and regardless of the sources of finance.

6 Innovation performance is measured by the Summary Innovation Index (SII) which combines 26 indicators and is calculated for those countries for which adequate data are available.

States. This significant innovation gap between the EU25 and Japan is increasing and the one between EU and US is close to stable.

The European Commission has addressed the resulting urgent need to act in its communications *An action plan to boost research and innovation* (EC 2005c) and *Implementing the Community Lisbon Programme: More Research and Innovation - Investing for Growth and Employment - A Common Approach* (EC 2005d). These communications highlight the importance of Private Sector R&D investment. Two-thirds of total R&D spending should come from private financing. The business sector financed 54% of total European R&D expenditure in 2003, compared to 63% in the US and 75% in Japan[7].

There has been a slow-down in business funding of R&D. Business funding grew at a slower rate than GDP and the business share of R&D spending is decreasing. The European Commission's action plan states: "*Therefore the EU needs to consider the conditions within which businesses finance innovation and R&D spending, and see how these can be improved*".

The *Integrated Guidelines for Growth and Jobs (2005-2008)* summarise the need to act in this area (EC 2005e):

> *"Member States should further develop the mix of measures to foster business R&D through: improved framework conditions and ensuring that companies operate in a sufficiently competitive environment; increased and more effective public expenditure on R&D; strengthening centres of excellence; making better use of support mechanisms, such as fiscal measures to leverage private R&D; ensuring a sufficient supply of qualified researchers by attracting more students into scientific, technical and engineering disciplines and enhancing the career development and the transnational and intersectoral mobility of researchers."*

The EC member countries, working together in the Open Method of Coordination (OMC) with the support of the European Commission have recognised this need for improvement. OMC's first reporting cycle has identified this area as one of five key working areas. The working group on 'The Public research base and its links with Industry' recommended to '*encourage the reform of public research centres and universities, in particular for promoting transfer of knowledge to society and industry*' and to '*involve the Private Sector in shaping public research programmes*' (see CREST 2004a for details).

1.2 Need for Private Sector involvement in Public Sector research policy decision making

A recent study, published by management consultancy Accenture in collaboration with the Lisbon Council, highlights key industry sectors where Europe has the potential to create a total of 10-14 million new jobs over the next five years, "as long as it puts in place the right conditions for growth" (Accenture 2005). According to this study, "achieving this growth is about creating the right policy environment in which high performance businesses can flourish". This study recommends to introduce a tiered regulatory environment for high-growth companies, to implement industry-specific strategies around which all stakeholders are aligned to channel support, to frame suitable incentives to develop key 'innovative clusters' and to maximize their impact on the wider economy. For this purpose the wider networks among business, government and academia should be increased. The study states:

> *"The other frequently overlooked aspect of competitive advantage concerns the interactions between firms in an industry and the wider networks – of governments, research institutes, universities etc. – within which they are embedded. Its significance is three-fold. First, it is about expanding the wider networks between these stakeholders to increase the commercialization of research – for example, the Science and Technology Council in Finland brings together the public and private sectors to formu-*

[7] Source of data: Eurostat 2005a

late national science, technology and innovation policies and has systematically promoted new technologies, research and development, and new business creation over the past couple of decades. Second, it is about creating denser networks between firms, industries and the wider economy. For example, Nokia employs about 23,000 employees directly, but its wider employment impact is much larger with about 18,000 indirect jobs among subcontractors and partner companies in 2003, and important innovation and employment impact in related sectors such as transportation and retail[8]*. Third, it is about recognizing that such industry networks are often regionally concentrated and that there is considerable potential for growth by promoting those clusters as regional hubs of knowledge creation and utilization …*

… Public policy … can promote the external image of a cluster or region through stronger branding, it can address gaps in the private supply of venture capital through research and development funding and taxation incentives, it can assist in skills accumulation through vocational training initiatives and better planning and it can create incentives and mechanisms for enhanced university-industry collaboration."

Both policy makers and Private Sector decision makers have recognised this need for increased interaction. As a result, intensive interaction has evolved in particular in the field of innovation, where close interaction between regional policy makers, companies, research institutions and other stakeholders has become the driving force behind the successful development of innovative clusters and regions in Europe. Evidently, this applies to the whole innovation chain, from basic research to market success. In its Community Strategic Guidelines 2007-2013 for Cohesion Policy (EC 2005f), the European Commission states: *"The specific nature of RTD*[9] *must be considered when implementing regional policy. In particular, RTD requires close interaction between the players to encourage the formation of poles of excellence which are needed to reach critical mass."*

In the course of this development, the nature of Public Sector – Private Sector research interaction has gradually changed and been extended (see Figure 1):

- Traditionally, public research focused on scientific excellence and was funded by government without any consideration of the application potential of research results. There was little interaction with Private Sector R&D, which was carried out mostly by industrial R&D laboratories. Obviously, Private Sector interaction in public research policy definition and execution was very limited under these circumstances.
- Intersections between both sectors grew with the understanding of the value of research results as basis for innovation processes, leading to marketable technologies, products and services. The resulting desire to enhance the transfer of scientific knowledge and joint value creation led to policy measures which target this interface. Typical examples include large scale collaborative research programmes, technology transfer measures or tax schemes to stimulate Private Sector research. In the course of this development, research policy decision makers became increasingly aware of the need to involve the Private Sector in the instigation, design and implementation of research policy measures.
- Under the growing pressure of competitive global markets and of accelerating development and product life cycles, both sides have further increased their research policy-related interaction. The objective is to ensure efficient and seamless innovation processes, based on research results with a high relevance for the development of new products/services, thus contributing to economic growth and secured employment. The current trend towards innovation taking place in clusters where Public and Private Sector actors co-decide and co-implement their research policies takes this even one step further towards an intensive involvement.

[8] Statements about Finland quoted from Accenture 2005, see country report Finland for a detailed profile created in this study.

[9] RTD: Research and technological development

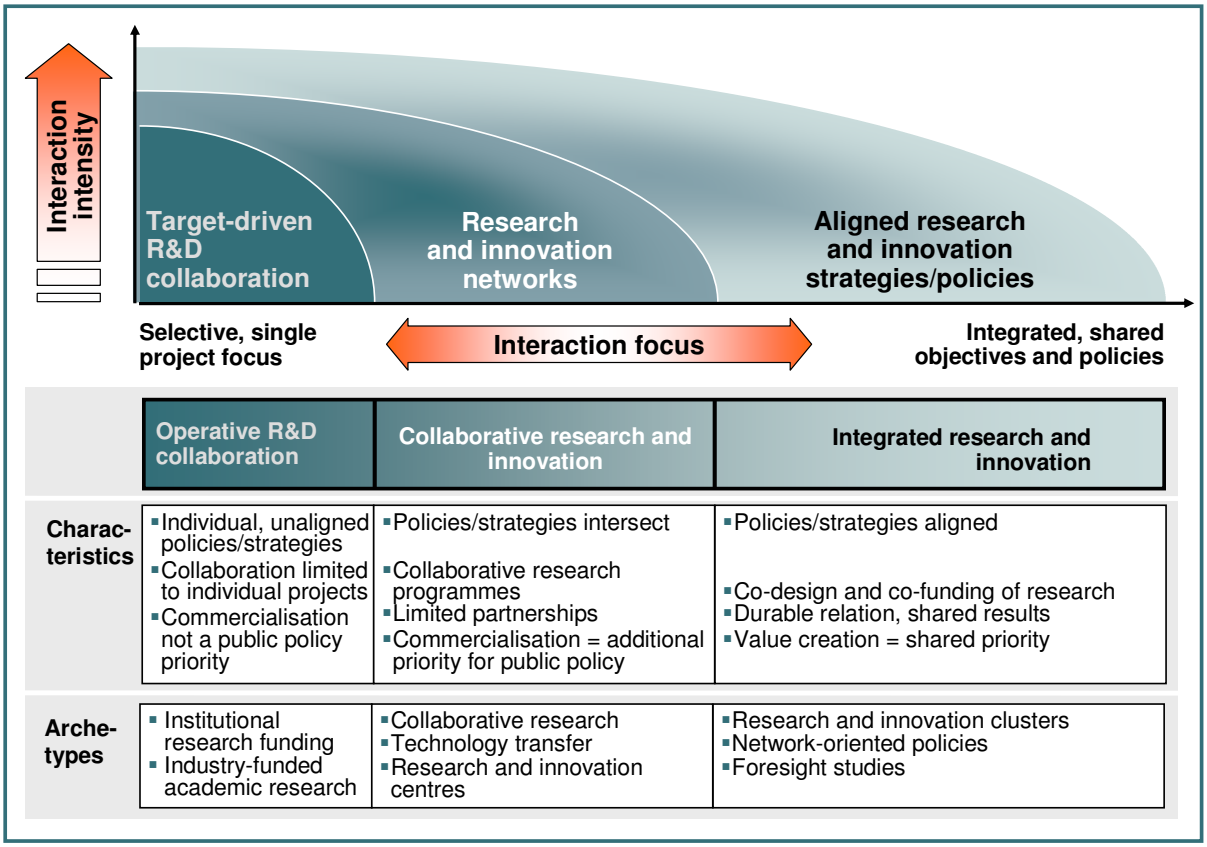

Figure 1: Types of Public Sector – Private Sector research interaction

1.3 Leverage from Private Sector involvement in public research policy decision making

Concerning the high importance of an efficient Public Sector – Private Sector interface, the OMC working group on the *Public research base and its links with industry* states that '*creating a more dynamic public research base that is better aligned to the needs of Private Sector R&D is an important element in stimulating the overall growth of R&D activity and in supporting more effective R&D links with the Private Sector*' (CREST 2004b). Among other areas, this working group identified a better Private Sector interaction in research policy making as a priority improvement area. It states:

> *'There are few explicit initiatives that specifically encourage Private Sector participation in to how they can become more involved in R&D and in the formation of national research and innovation policy. In the former context, there are few specific schemes to get Private Sector firms more interested in the possibilities of the benefits of undertaking R&D. This remains a significant barrier and is fundamental to all the other schemes and initiatives mentioned in this report. For example, firms will not get themselves involved participating in Public-Private-Partnerships, if they do not see any benefit in undertaking or being involved in research and innovation themselves. Nor will they take active part in shaping R&D and innovation policies.'*
>
> *…*
>
> *'The Group recommends, on a general level, the identification of good practice procedures for including firms in national and other foresight programmes. The Expert Group felt it was necessary to consider novel ways in which a wider set of firms could be involved in areas such as foresight and other policy formation processes.'*

The motivation for involving the Private Sector in research policy making is closely linked to the leverage which each side can achieve from this. However, the reasons for this type of interaction and the expected results from it depend on the specific situation and needs of each side (see Figure 2).

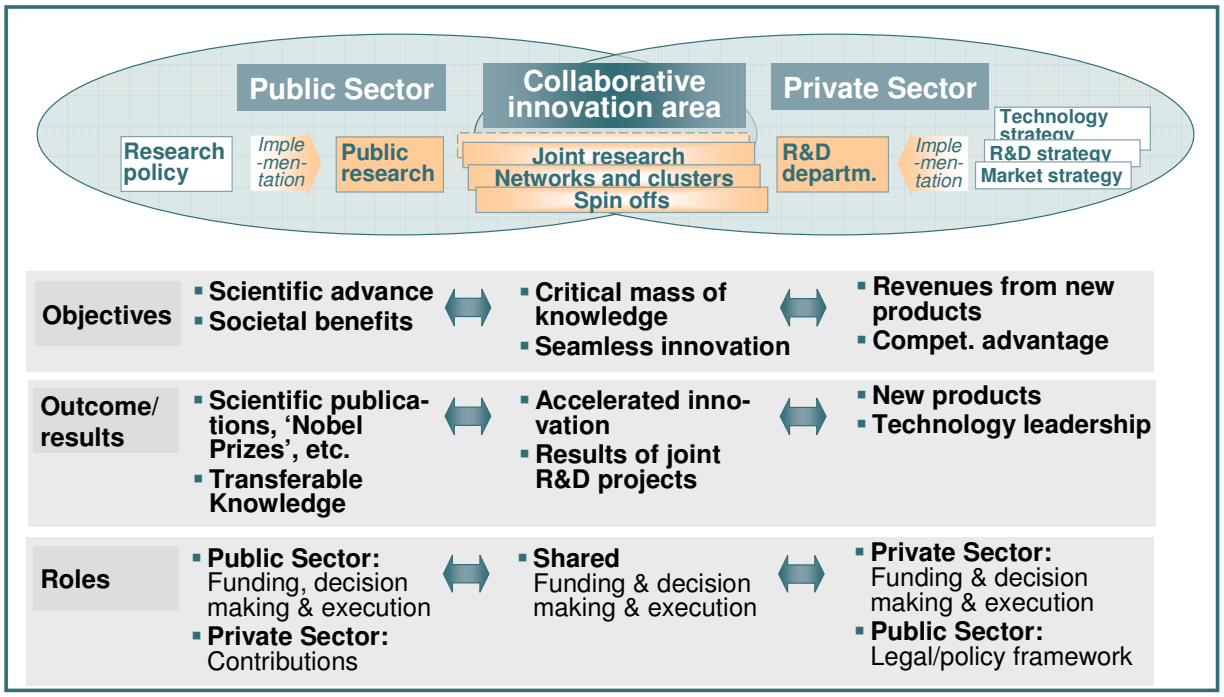

Figure 2: Distribution of roles between Public and Private Sector

For the Public Sector side, the achievement of the Lisbon objectives and in particular of the 3% goal is the predominant motivation to involve the Private Sector in research policy decision making. Private Sector involvement can contribute to this in several ways:

- *Quality and relevance of research policies, leverage from Public Sector research*

  The exchange of ideas with Private Sector actors adds new creative potential to the instigation of new policies and to the spectrum of possible policy approaches and instruments. In the choice of options and in policy design, immediate feedback from the 'main client' of commercially relevant research results helps to ensure the relevance and efficiency.

  Moreover, such a constructive dialogue can help to ensure that public research funding and research performed by Public Sector research institutions are targeting areas and results with a high potential in terms of innovation, new product/service generation, economic growth and competitiveness.

- *Enhanced awareness and sustained research commitment from the Private Sector, especially from SMEs*

  The OMC working group on the Public research base and its links with industry emphasised *"… that for Private Sector firms to (be) more actively participating in shaping public research activities, belies a more fundamental prerequisite, namely that firms need to recognise the value of R&D more generally for them to then feel it worthwhile to participate in influencing the nature and extent of public R&D activity. Thus, active participation requires, in addition, awareness of the value and benefits of R&D more generally. Large sections of the Private Sector, particularly Small and Medium-sized Enterprises (SMEs) and service enterprises, do not recognise the value of undertaking R&D and therefore forego good opportunities for innovation. In relation to this, they are often overlooked as possible partners in public-private R&D partnerships, a key vehicle to reaching the Lisbon targets"* (CREST 2004b).

In this spirit, an enhanced interaction between both sectors is expected to help get more companies interested in research and its benefits. Such companies are also more likely to develop an interest in getting involved in research policy issues.

- *Stimulation of national and European Private Sector R&D investment*

  For national policy makers in EU Member States, it is not and will not be sufficient to stimulate Private Sector R&D investment *per se*. The second challenge is to create conditions which encourage companies with a strong dedication to R&D to direct these investments towards European countries. Private Sector enterprises are free to invest in projects and research facilities anywhere in the world. And especially the global players tend to prefer environments where the legal and policy frameworks are supportive, where a strong base of competent research partners (i.e. in Public Sector research) exists and where they find 'open ears' for their needs (e.g. for (co-)funding of exploratory research or for optimal regulatory or market conditions).

- *Strengthening of the links between the public research base and industry*

  Another important CREST recommendation is to "*… support measures to enable public research institutions to develop more effective links with industry, in particular SMEs, while safeguarding their public mission in education and fundamental research."* (CREST 2004a). As Chapter 3 shows, a variety of instruments to involve the Private Sector in particular on an operative level have the potential to stimulate and strengthen such links.

The reasons and criteria which motivate the Private Sector to devote efforts to its involvement in Public Sector research policy are very different. They include:

- *Representation of the interests of commercial actors in research policy making*

  Policy making implies a competition of different views for supremacy on how issues should be addressed[10]. As the main 'absorber' of the results and knowledge which research generates, the Private Sector has a vested interest in playing a strong role in this negotiation process. If the Private Sector does not manage to make itself heard, a kind of structural imbalance is created, whereby policy focus and necessary resources could be diverted away from areas where companies need them most for the successful conversion of valuable research results into new products/services.

- *A strong and well-performing National Science System as a source of innovation*

  In view of the importance of Public Sector research as a source of scientific progress and technological competency for the overall innovation process, the Private Sector has a strong interest of its own in contributing to the development of National Science and Innovation Systems. Through its involvement in research policy decision making, Private Sector actors can contribute significantly to

  - the expansion of scientific research into areas with a high application potential for future commercial exploitation and competitive advantage;
  - the development of a well-performing national scientific competency base and research infrastructure and the availability of highly skilled and trained scientific staff;
  - access to state-of-the art scientific knowledge, collaborative R&D and the development of research and innovation networks to extend their own research base;
  - creating more absorption capacity for public R&D.

- *Enabling and support of necessary research and development*

  Under the actual competitive and margin pressure of global markets, companies (in particular SMEs) frequently do not have the necessary capacities and resources to perform long-term oriented exploratory and/or high risk research. If this leads to a deterioration of the technological skill base, this can jeopardise future competitiveness. A possible impor-

[10] See the background paper (Appendix A4) for a discussion of research policy decision processes.

tant task of research policy is to help find a way out of this dilemma by (1) providing necessary incentives for long term, high risk pre-competitive research which otherwise would not take place and (2) making sure that companies find competent partners in the public research base for such collaborative research. But to enable this, Private Sector actors must have a reasonable impact on the instigation, design and execution of such research policies.

- *Relevance of Public Sector research for value creation by Private Sector-driven innovation*

  As a consequence, the Private Sector has also an important interest in getting involved in the definition of priorities of Public research at a more operative level. Within the overall framework of research policies, individual public research institutions develop their particular competencies and define their portfolio of research projects. Observations made in the course of this study confirm that Private Sector involvement at this level helps considerably in building and strengthening links between public research institutions and their Private Sector counterparts. This leads to efficient transfer and collaboration processes.

- *Trusted links and research/innovation networks*

  Finding the right research partner and cooperating efficiently is particularly challenging for smaller Private Sector actors which are less familiar with structures and actors of public research and have no experience in cooperating with them. Such companies can benefit considerably from a more intensive integration in research and research policy networks as a starting point for building their own networks and getting involved in collaborative research and technology transfer.

1.4 On which issues is the Private Sector involved?

Theoretically, the Private Sector may be involved in almost any type of research policy decision. In practice however, such interactions are mostly focussing on areas where the Private Sector can make valuable contributions and where it is motivated to undertake the necessary effort because of the perceived benefits. This creates certain asymmetries:

- Private Sector interaction is more intensive in research areas with a high commercial relevance, e.g. in the natural, engineering and medical sciences.
- The closer research and its results get to commercial relevance, the higher the level of general interaction becomes. Therefore applied research, technology development and the transfer of research-based knowledge and results are 'natural' areas for an intensive interaction, as opposed to basic research which aims at advancing knowledge.

Within these boundaries, our research shows that the nature and intensity of Private Sector interaction depends on the research policy process stage (see Table 1):

(1) Instigation of research policies

As the most important 'absorber' of commercially relevant research results, the Private Sector has an obvious interest in priority setting on research areas where scientific progress can make major contributions to economic growth. The growing demand for tangible contributions of science to the welfare of societies creates additional motivation to involve the Private Sector in the identification of national research needs and priorities in many countries, especially in areas like applied research and its interface with innovation policy. But to some extent, Private Sector involvement in the instigation of policies in the areas of basic research, of research infrastructure and of education and human resources has also gained importance.

Type of decision / policy question		Typical questions and topics	Private Sector relevance	Private Sector contribution	Initiated by	
					Public Sector	Private Sector
Research policy instigation	**National research policy need**	▪ Role of research and innovation jn overall national policy? ▪ Level of overall state intervention (Dedicated policy ↔ „Do nothing“)? ▪ Actual/target position of research (relative to other policy areas) in national priorities?	▪ Ensure performing National Sceince&Innovation System - competency and initiatives in relevant areas - transferable knowledge - etc. ▪ Specific Private Sector needs (e.g. development of new technology areas)	Typical roles: ▪ Advisory ▪ Consultative ▪ Lobbying	✓	✓
	National research priorities	▪ National research position and portfolio (target vs. actual)? ▪ Intervention in which sectors? ▪ Specific target groups? ▪ Instruments for Public Sector intervention (e.g. research funding, tax incentives, etc.)?	▪ Fit between Public Sector research policy and Private Sector R&D/innovation priorities? ▪ Policies/strategies mutually supportive?	▪ Advisory ▪ Consultative ▪ Lobbying ▪ Promote own priorities ▪ Provide expertise	✓	✓
	National research framework	▪ Optimisation of policy making decision processes & structures ▪ Structure and development of public research infrastructure	▪ Transparent and rational policy decision making ▪ Reactivity to Private Sector views and needs ▪ Value/credibility of public research as R&D partner	▪ Express own needs ▪ Critically supportive (incl. ‘Devil’s advocate’ role)	✓	✓
	Sectoral / regional research policies	▪ Need for/potential of intervention in sector/region …? ▪ Sector-specific priorities and objectives? ▪ Instigation and design of sectoral / regional initiatives	▪ Fit with PS R&D strategies? ▪ Needs (e.g. support for high risk research, public research competencies, collaborative research)	Often in a more partnership type role (incl. co-design and -management)	✓	✓
	Stakeholder involvement	▪ Who are the relevant stakeholders? Should they be involved? On which issues? In which depth? ▪ How to reconcile different needs of actors/stakeholders?	▪ Appropriate overall level of Private Sector involvement ▪ Balance view of different subgroups (e.g. large industry vs. SMS’s)	Lobbying	✓	
Research policy design	**Level and type of intervention**	▪ How intensive should the state intervene (Massive intervention ↔ punctual support ↔ “stay out”)? ▪ What type of intervention should be applied (Direct research funding ↔ indirect measures (e.g. tax schemes) ↔ pol./admin. framework ↔ infrastructure ↔ …)? ▪ For which time frame and target group should the policy measure be designed? ▪ How should the policy be implemented (e.g. via intermediate agencies, etc.)?	▪ Private Sector perception of needs, e.g.: - support for industrial R&D - improved leverage from public research - human resource base - ….. ▪ Value of state intervention (Supportive ↔ creating barriers)? ▪ Improvement potentials?	Typical roles: ▪ Advisory ▪ Consultative ▪ Lobbying	✓	✓
	Resource allocation portfolio	▪ On which research areas/sectors should research policy focus? ▪ How should resources be allocated to these areas?	▪ Direct state support to areas of highest need ▪ Avoid misallocations	Typical roles: ▪ Advisory ▪ Consultative ▪ Lobbying	✓	✓
	Policy area specific decisions	For each policy area identified: ▪ Specific policy targets and priorities? ▪ Type of policy instrument to be applied? ▪ Type of research to be supported (Basic ↔ applied ↔ …)? ▪ Resource allocation? ▪ Target groups?	▪ Private Sector perception and needs, e.g. - complementary with research strategies? - support needs - appropriateness of specific instruments ▪ Value of public intervention (from PS perspective)?	Frequently advisory/ consultative role Complementary own intiatives (e.g. white papers)	✓	✓
	National research infrastructure	▪ How should national research infrastructure be further developed, e.g. - refocus research areas? - invest in new research infrastructure? - enhance interfaces with the Private Sector (e.g. networks, technology transfer, etc.)?	▪ Private Sector perception of needs: - support of industrial R&D - improved leverage from public research - human resource base - ….. ▪ Value of state intervention (Supportive ↔ creating barriers)?	Occasionally (e.g. advisory/ consultative role, white papers, etc.)	✓	✓
	Human resource base for research	▪ On which research areas/sectors should research policy focus? ▪ How should resources be allocated to these areas?	▪ Direct state support to areas of highest need ▪ Avoid misallocations	Typical roles: ▪ Occasionally advisory/ consultative ▪ Lobbying (to secure own HR base)	✓	✓

Table 1: Research policy issues with Private Sector involvement

Type of decision / policy question		Typical questions and topics	Private Sector relevance	Private Sector contribution	Initiated by	
					Public Sector	Private Sector
Research policy implementation	**Execution at programme level**	▪ Short-term strategic decisions (e.g. adaptation of programmes, re-allocation of programme resources, etc.) ▪ Operational decisions (e.g. programme management: Resource allocation in a funding programme, Individual project evaluation and funding decisions) ▪ Necessity for corrective actions, e.g. - reallocation of priorities - portfolio adjustment - changes in important assumptions (e.g. research breakthroughs, changed market conditions, etc.)	Ensure ▪ relevance of policy measure (right targets reached & right projects stimulated?) ▪ Programme effectiveness/ efficiency (Right focus and contents, lean programmes, minimum administrative burden, etc.)	Typically low level involvement except: ▪ Advisory/ consultative (e.g. steering committees) ▪ Lobbying (if perceived misallocations or inefficiencies)	✓	
	Execution at operative level	▪ Short-term project internal decisions (e.g. stop-/go-decisions at project milestones) ▪ Cluster-internal strategies, project portfolios, etc.	▪ Ensure - Efficient execution and results of (joint) research - Build/maintain networks and working relations ▪ "Real time" transparency: - does policy/instrument create expected value for Private Sector? - assumptions still valid? - need for change?	▪ Typically intensive and direct involvement ▪ Interaction takes place at operative level (e.g. project/cluster internal)	✓	✓
	Policy/ implementation monitoring	▪ Observation of status/actual achievements and of effectiveness/efficiency ▪ Necessity for corrective actions, e.g. - reorientation of programmes - efficiency improvement measures - changes in important assumptions (e.g. research breakthroughs, changed market conditions, etc.)	▪ "Real time" transparency, e.g. - does policy/instrument create expected value for Private Sector? - assumptions still valid? - need for change?	▪ Currently at policy level mostly ex-post ☛ "Real time' info more valuable for PS	✓	
Research policy assessment/revision	**Policy evaluation**	▪ Has the policy - reached its defined scientific and technological objectives? - reached the desired target groups? - achieved the desired effects? - etc. ▪ Have priorities, instruments used and their implementation proven to be effective and efficient? ▪ Which conclusions can be drawn for a next generation of policy measures in the same field (e.g.: Follow-up policy measure necessary? Same/similar/new type of instruments suitable? Etc.)	▪ Private Sector perception - leverage for companies achieved? - strengths, weaknesses, improvement potentials? ▪ Appropriate consideration of Private Sector needs,e.g. - further support necessary? - revised strategic priorities - changed market conditions, industry structures, technological progress - etc.	Frequently involved, but not 'in the driver's seat' (e.g. participation in evaluation studies)	✓	✓
	Policy revision	▪ Is there a need for - continuation of current policy? - modification or redesign of resource deployment, instruments, approach, target groups, etc.? ▪ Should policy priorities be reoriented - within the policy area pursued so far? - to other policy priorities? ▪ Design of next generation research policy	▪ Appropriateness of next generation policies - needs of the Private Sector (competitiveness, etc.)? - Complementarity with corporate R&D strategies?	Typically advisory/consultative (e.g. participation in working groups, steering committees, advisory bodies, etc.)	✓	✓

Table 1(continued): Research policy issues with Private Sector involvement

(2) Design of research policies

In the design of research policies, Private Sector involvement and contributions focus again on scientific areas with a high expected economic relevance. The objective is to help policy makers in the conversion of identified research policy priorities to appropriate direct or indirect policy measures and to position the achievable economic leverage correctly in relation to other research policy objectives[11]. Typical examples for such areas of a shared high interest of both Public Sector research policy makers and Private Sector stakeholders include the allocation of government resources to collaborative research programmes or the introduction of tax schemes to stimulate Private Sector research.

But as the traditional borders between basic and applied research become more and more fluid, there is also a growing tendency to interact in other areas. This includes the

[11] For a detailed discussion, see the background paper in Appendix A4, page 118 ff.

design of basic research policy approaches, of policies for the development of the national research infrastructure and the human resource and skill base[12] and of major research institutions' policies.

(3) Implementation of research policies

Private Sector companies are important recipients of public funds for research which they carry out themselves or perform in collaboration with Public Sector research institutes. They can also be important providers of funds for Public Sector research. But current practice is that operative decision making during the execution of Public Sector research programmes is the sole responsibility of policy makers. These policies are usually executed by specialised Public Sector agencies with little Private Sector input. Private Sector influence is limited in most cases to providing advice and feedback, except at the level of regional or thematic clusters. Here, Private Sector actors take a direct stake and are integrated parts of decision processes and structures.

(4) Assessment and review of research policies

The typical instruments used for policy assessment (e.g. ex-post evaluation studies, carried out under the auspices of responsible policy makers) involve the Private Sector as a stakeholder and participant in such programmes. But this represents a more indirect mode of interaction. Typically, interviews with research programme participants, panels, etc. are used to extract the feedback of Private Sector actors. When such assessments result in discussions about the need for follow-up research policy measures and their potential focus, Private Sector interaction can be re-intensified to ensure appropriate consideration of its needs in a next generation of research policy measures.

1.5 Does "more Private Sector involvement" mean "better research policy decisions"?

As the traditional separation between Public Sector research policies and Private Sector R&D strategies narrows, interaction between both sides is continuously gaining in importance. Chapter 1.4 demonstrated that benefits from an intensive interaction in the research policy domain are obvious especially in research areas with high (actual or potential) commercial relevance. The growing need to fuel innovation with research-based state-of-the-art knowledge and scientific progress suggests that intensification of this type of involvement is beneficial to both Public and Private Sectors. At the same time, the Private Sector's interest in being involved in research policy is increasing. In the R&D strategies of commercial enterprises, Public Sector research has gained importance as a source of innovative technologies and as R&D partner. This mutual interest has encouraged new forms of interaction and of collaboration, which go far beyond traditional approaches to involve the Private Sector in research policy decisions. Overall, there is widespread consensus that Private Sector interaction adds value to Public Sector research policy making.

But one should not forget that both sides pursue different objectives in this interaction, driven by different underlying decision criteria and processes (Figure 3 describes the different generic sets of criteria which are applied by the Public and the Private Sector and potentially occurring trade-off considerations resulting from these). Public Sector research policy decision makers have to balance the advancement of scientific knowledge, the achievable micro- and macroeconomic impact of research (including creation of new employment, etc.) and contributions to the solution of societal problems, e.g. in the environmental and health areas. Therefore, research policy decision making tends to be a complex process which is influenced by the views of various policy domains and stakeholders. This wide spectrum of policy objectives and public budget constraints often impose compromises. The Private Sector is not neutral in such decisions – it is a stakeholder with an explicit focus on the economic

[12] The availability of highly skilled scientific staff is increasingly considered as a key prerequisite for successful Private Sector R&D.

benefits of research! And often, a strong and dedicated research investment is only one of several available strategic options for firms which will have to compete with other types of investment, such as the development of new markets.

For this reason, almost all actors agree that the Public Sector and its policy makers are primarily responsible for research policy decision making. But the Private Sector can contribute considerably to this process.

In the instigation and design phases, the Private Sector adds considerable knowledge to the policy making process and can be a valuable source of alternative ideas and concepts. In a role as negotiation partner and/or 'sounding board', the Private Sector can also be an important corrective element, ensuring that policies instigated and designed by public authorities are realistic, feasible and create new knowledge in attractive areas for following Private Sector innovation activities. In addition, Private Sector know-how in the management of strategic and operational programmes and projects adds to the development of efficient budget, risk and programme portfolio management tools, etc. and to the efficient transfer of new scientific know-how to commercial applications. In the implementation and review phases, Private Sector feedback frequently is an important element of a realistic assessment of the efficiency and effectiveness of applied policy measures and a valuable source of for the identification of improvement potentials.

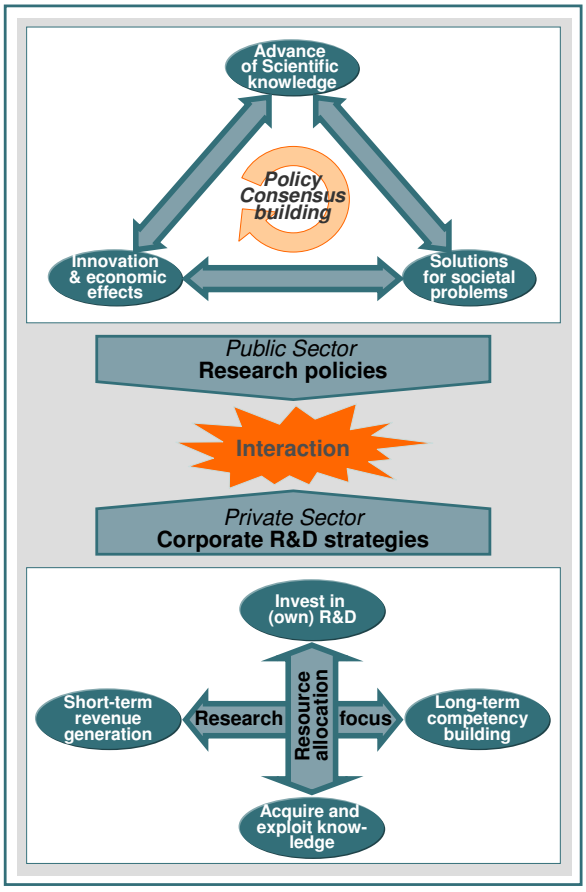

Figure 3: Underlying decision criteria and processes influencing research policy decision making

From the Private Sector's viewpoint, a dedicated involvement in research policy making has also considerable value. As commercial R&D departments have been reduced over the last years under the cost pressure of global competition, Public Sector research has gained importance for industry as a source of advanced technological knowledge and of innovation. Therefore it is more and more essential for Private Sector actors to be able to influence Public Sector research policy and its implementation.

The emergence of cooperative research and innovation in thematic or regional clusters has also created new collaborative forms of regional or sectoral research policy formulation and implementation for the benefit of both sides. Typically, research policy making institutions play an important role as instigators and supporters of such clusters, but intensive Private Sector participation is the key to their success.

In a summary view, strong Private Sector interaction contributes to the improvement and advance of research policies. But for policy makers, there is also a permanent trade-off between getting the Private Sector more involved (which may help to improve research policies and achieve leverage in Private Sector R&D investment), giving enough room for the Private Sector's own initiative through a minimum of regulation and the need to find a fair balance between economically important research areas and those which are of less interest for the Private Sector. Finding the right measure and form is essential: 'More Private Sector involvement' does not mean automatically 'better research policy decisions'! And as the follow-

ing case study summary[13] shows, there are even situations where policymakers need the perseverance to promote their own strategic long-term objectives irrespective of differing short term Private Sector objectives.

Case study BioRegio (Germany): Changing research policy paradigms

In the mid 1990's, Germany's biotechnology sector was considerably lagging behind other leading industry nations. Molecular biology had been identified as a future key technology as early as 1974. But two decades of 'conventional' research policy had not succeeded in creating a critical mass of research and innovation potential. A crucial problem was the absence of small, dedicated biotechnology companies and start-ups from academic research, which play an extremely important role in driving discovery and commercialisation of knowledge. And the chemical and pharmaceutical industries, which had maintained their focus on traditional technologies for a long time, preferred to invest in biotechnological research in more dynamic countries. Germany was in danger of 'missing the boat'.

Obviously, a continuation of the traditional research funding approach would not be enough to turn this situation around. Germany needed a new policy approach which would stimulate the development of a competitive research base, a rapid transfer of scientific results from the laboratory to the market place, a critical mass of young, innovative companies and prevent a drain of talent and a walkout of industrial research to other countries.

Confronted with this situation, the responsible federal research ministry BMFT[14] announced the BioRegio competition in 1995. As a prototype of a new policy approach, BioRegio's aim was to promote designated biotech regions as centres of growth and to stimulate interregional competition. For this purpose, a call for applications of regions was issued. The winning three applicant regions got access to special federal funding of DM 50 million each over five years for research in their regional interdisciplinary networks. An additional incentive was that companies from these regions were granted preferential access to the funds of the general federal programme *Biotechnologie 2000*[15].

The call did not request a specific size or organisational framework. The contesters were free to define these in accordance with their specific needs and ideas. But an important condition was that for any project to receive funding, at least half of the necessary investment had to come from private sources.

The BMBF estimates that BioRegio and its successor programmes have mobilised investments of a total of over 1 billion Euro. Of this sum, approximately 90% have been supplied by the regional actors, in particular by the Private Sector companies involved. The regional effects include the formation of new biotech companies, the creation of new highly skilled employment and the development networks linking scientists and companies.

It is particularly remarkable that this effect has not been limited to the three winning regions. The BioRegio competition has created a high level of awareness and stimulated activities and networks which developed their own dynamics in almost all of the 17 competing Bioregions from all parts of Germany which had submitted proposals and even beyond this group. It is generally recognized that the BioRegio competition has been the 'kick start' for the recovery of Germany's biotechnology sector.

BioRegio's competitive approach has proven its potential as a complementary research policy instrument to stimulate regional innovation clusters and interregional competition in high potential technology areas.

[13] Short summaries of the case studies performed during this study are used in the main text to illustrate specific issues. For details, please refer to the full case studies in Appendix A5.

[14] Federal Ministry for Research and Technology, later renamed to BMBF (Federal Ministry for Education and Research)

[15] BioRegio was embedded in a broader policy approach, including enhanced research funding and accounted for only 21% of all federal funds for life science research in the period 1996–2001.

2. Factors influencing the nature, intensity and impact of Private Sector interaction in research policy decision making

2.1 The actors in the research policy decision process

In their interaction, stakeholders and their representatives are not in an equal position. Research policy makers, Private Sector representatives and other stakeholders each pursue their individual objectives. But in doing so, they have different degrees of freedom, as shown by Figure 4. At a first glance, policy makers may appear as being in a 'stronger' position as the ultimate decision makers. But at the same time, they are also often much more bound by the need to align their decisions with general policy guidelines and to find compromise solutions accounting for a multitude of policy objectives and interests.

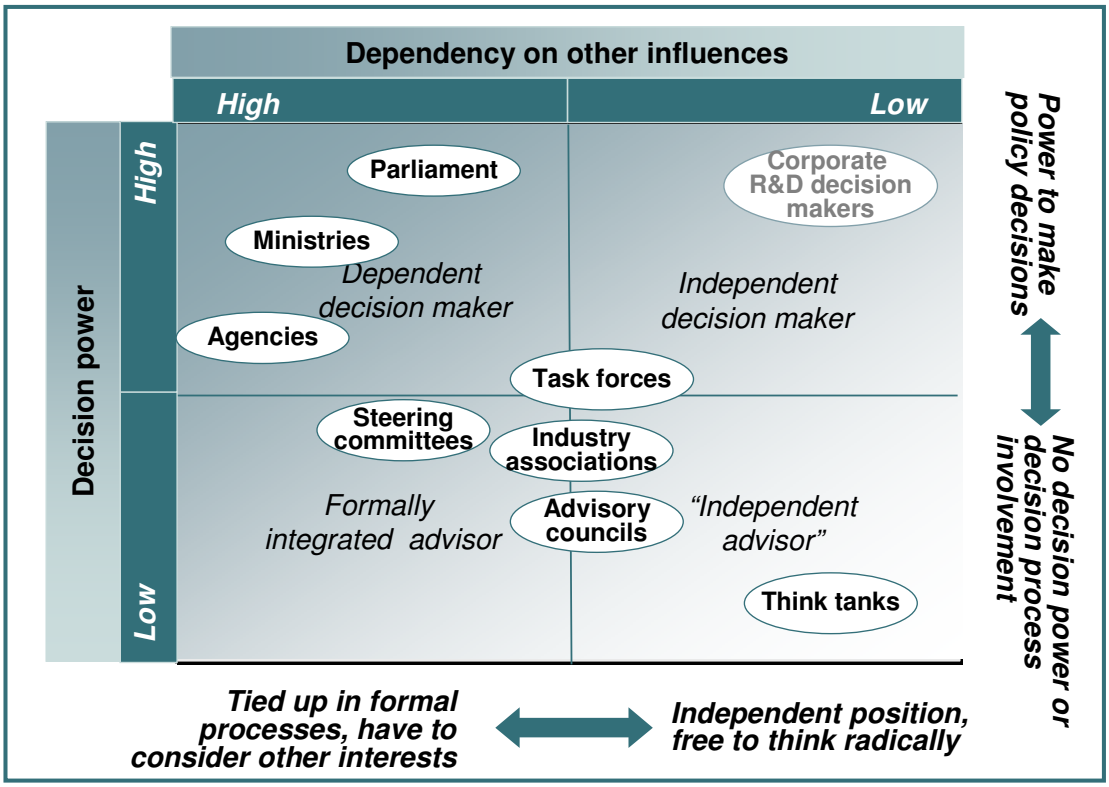

Figure 4: Different degrees of freedom for actors in research policy decision processes

In the following section, the major groups of actors involved in research policy making are described in more detail:

(1) Policy makers: Political, administrative and intermediate institutions

On a national[16] political level, objectives and overarching framework for research policy are constituted by the parliament and by the government. For this purpose, many parliaments maintain special committees, where important research and innovation policy issues are discussed and decisions are prepared. At the government/ministerial level, responsibility is typically assigned to a research ministry[17].

[16] Typically, in federal structures the states of the federation define their own research policy, implemented by a state ministry. Frequently, this takes place in the framework of split responsibilities, where for example the national government is responsible for overall research policy and infrastructure, while the states are responsible for (higher) education institutions and their research.

[17] In ERA countries, responsibilities for research and for innovation are allocated in different ways. In terms of decision-making and expertise, innovation is likely to be spread across a number of Ministries (e.g. Economic Affairs, Trade, Competitiveness) whereas research is likely to be embodied

To implement research policies and to support their development, governments use increasingly specialised agencies. Typical tasks of such agencies include studies and concept development in preparation of new policies, monitoring of the performance and status of National Science and Innovation Systems, management and administration of research programmes, support of knowledge and technology transfer, etc. This may have two effects: On one hand, agencies which focus on the implementation of research policy measures (e.g. research funding programmes) tend to be 'close to their customers', the Public and Private Sector research performers, which eases communication. But on the other hand, the introduction of this additional layer may also reduce the direct interaction between the (ultimately responsible) ministries and the Private Sector, thus limiting the communication and understanding between these groups.

Many governments have set up special mechanisms or organisational frameworks to involve the Private Sector and other stakeholders appropriately in the instigation and design of research policies, typically in an advisory or consultative role. The degree, to which this has been implemented ranges from informal consultations to sophisticated, institutionalised advisory structures. We have observed a trend to widen and reinforce this type of involvement and to use more dedicated and sophisticated forms (including joint initiatives). In the policy implementation and evaluation stages, the classical forms, advisory or steering committees, are complemented in some countries by more action-oriented innovation platforms. The case study on the Dutch research policy advisory system on the following page illustrates how such elements are combined to a powerful national advisory landscape.

(2) Public Sector research performers, service and financing institutions

Public Sector research is carried out by higher education institutions, public research organisations and, to a far lesser extent, by not-for-profit organisations. Typically, their overall guidelines are defined by governments in the context of national or regional research policies. But each type of institution usually has a high degree of autonomy for defining their research strategies according to their specific situation and needs. Large research organisations[18] with their own significant budgets and a multitude of institutes usually enjoy a particularly high degree of freedom to develop and implement their own elaborate research strategies.

Traditionally, research policy decision-making at the level of higher education institutions and public research organisations took place within these institutions. But in recent years there has been a growing tendency to integrate complementary external knowledge. For example, Danish universities have installed governance boards consisting of both internal academic members and Private Sector representatives to ensure that academic strategies are linked to the requirements of Denmark's innovation performance and its Private Sector actors.

In some countries large research funding organisations, which do not depend directly on governmental research policy guidelines, may also have a considerable impact on research. For example, in Germany the Deutsche Forschungsgemeinschaft (DFG) funds academic research with a budget of approx. 1.3 billion Euro, based on the principle of self-governance of academic research. Decision making in DFG is a peer process, the Private Sector is not formally involved.

with fewer people on a more restricted/concentrated number of services (frequently with a ministry responsible for research at the heart of these services).

[18] This applies to institutions with a basic research orientation like Germany's Max-Planck-Society as well as to organisations with a market-oriented research agenda, e.g. TNO in the Netherlands.

Case study Netherlands: Advisory Councils as a strong institutionalised element of research policy making structures

The Netherlands have a long tradition of involving stakeholders, including the Private Sector, in instigation, design and review of policies through participatory, consensus-oriented interaction. Nevertheless, today's policy advisory structures and processes are the result of a restructuring which started in the 1990's. At that time, over 300 permanent and temporary advisory bodies existed to advise government and its organs on policy issues. This system was increasingly perceived as being overly complex, opaque and inefficient.

The replacement of this historically grown advisory 'landscape' by a new, lean structure took place stepwise, accompanied by an extensive public debate and contributions from existing advisory bodies and various stakeholders. As a result, twelve high-level advisory councils, reporting to the cabinet and/or directly to the responsible ministries directly were established. These cover both important functional policy domains and sectors, applying cross-functional skills through participation of high-level experts and decision makers from a multitude of stakeholder groups (with a strong Private Sector share in most councils).

Taken over from the previous system, the Advisory Council for Science and Technology Policy (Adviesraad voor het Wetenschaps- en Technologiebeleid, *AWT*) assumes the role of advisor in research and innovation issues. The AWT reviews Dutch research and innovation policies and advises on government's research activities and spending in key sectors. Representatives of science, government and society (including NGOs and Private Sector) are equally represented in a tripartite form.

To provide government with top quality, independent advice, these councils are established as autonomous bodies with an own legal and resource base to secure their function and independence. A law, issued in 1997, and regulations based thereon, define the roles, duties and rights of the councils. This includes rules for council membership and an obligation for the government to react formally to statements of the councils within a given time frame.

An important characteristic of the Dutch policy governance and advisory system is its dynamic evolution, driven by intensive participation of stakeholders and supported by policy studies from national and independent institutions. During 2002, the insufficient progress towards the Lisbon agenda and the need to meet economic recession lead to growing impatience. Among others, several important stakeholder organisations, including the employers' organisations, expressed the need for a more stringent national coordination and initiative. Recognising that existing councils, whose mission is a purely advisory one, would not be sufficient to fulfil this additional task, a complementary *Innovation Platform* was installed by Royal Decree for a three-and-a-half year period.

As the cores of Private Sector interaction, *AWT* and the *Innovation Platform* are embedded in a more comprehensive advisory landscape and unite a group of high-level representatives of the actors in the Dutch innovation system among their members and complement each other: *AWT* focuses on advising government and parliament on middle- to long-term research policy issues of general high importance, for example the design of possible future main development lines of the Dutch Research and Innovation System. The *Innovation Platform*'s mission is to act as an 'ice breaker', which drives innovative approaches in research through specific initiatives, including proposals to stimulate the development and application of knowledge and the cooperation between academic institutions and companies.

Another key element of the Dutch advisory system, maybe adequate also for application to comparable systems in other countries, is the ongoing intensive debate on how to further enhance the Netherlands' innovation performance, including options for improvement of the governance and advisory framework. However, the specific national culture of extensive stakeholder interaction with the often cited consensus orientation ('Polder model') might be responsible for having facilitated this process in Dutch policy making.

Other important elements of national research infrastructures, for example scientific service or technology transfer institutions usually operate also in the framework which is set by Public Sector research policy.

(3) Private Sector: Enterprises, associations and charities

Private Sector research strategies are formulated and decisions are taken internally on the enterprise level and are based solely on commercially-oriented strategic and financial criteria. However, interaction with Public Sector research policies and institutions takes place in a variety of ways, including Public Sector funding, collaborative research and research clusters.

Different types of Private Sector actors interact with the Public Sector in research policy decision making. These include the following:

- *Industry associations and joint initiatives*

  On a formal level, industry associations are the key representatives of the Private Sector in research policy making. Depending on the specific national context, they provide advice, 'white papers', etc., participate in formal consultations and maintain a permanent dialogue with public authorities. But they can also take far-reaching own research policy initiatives as the following industry examples shows.

  Usually, overarching industry associations act as the overall 'spokesmen' of the Private Sector on research policy issues of national importance. This is often complemented by more specific contributions of sectoral industry associations for their specific issues[19]. Industrial research associations can be another platform for the Private Sector to use synergies and to align and express its view on research policy issues.

  In some countries, special forms of joint Private Sector initiatives targeting contributions to research and innovation policy have evolved. For example, a group of Swiss Private Sector enterprises have founded *Avenir Suisse* to act as an independent think tank with a focus on the advancement of the Swiss research and Innovation System. Another example is the *Netherlands Society of Technological Sciences and Engineering* (Forum voor Techniek en Wetenschap, FTW), an independent platform for exchange on research and research policy issues, financed by annual membership fees, by donations of corporations, foundations and organisations and by government subsidies. FTW provides a platform for the discussion of technology, research and education policy issues and furthers contacts between research decision makers from all sectors with government institutions, social groupings and political bodies.

- *Enterprises*

  A possible imbalance may occur due to the varying degree of interest and active involvement in Public Sector research, depending on Private Sector enterprises' size, research and technology intensity and experience with Public Sector research funding, collaborative research, technology transfer, etc. Large technology- and research-intensive corporations tend to be the leading contributors to research policy making at this level. Often, they devote dedicated resources for this purpose. Such companies can also have an important influence through research funding. In contrast, SMEs, which are limited by their resource base and policy experience, tend to be less interested in and committed to interact in research policy instigation and formulation.[20]

[19] In most countries, sector-specific enterprise associations exist which often interact directly with their corresponding ministries.

[20] For a discussion of the imbalance between large industry and SMEs and of its consequences for Private Sector interaction in research policy making, see chapter 5.4.

Industry example: CEFIC's proposal for a collaborative approach to secure the chemical industry's future

As the forum and voice of the European chemical industry, CEFIC, the European Chemical Industry Council, has published recently a document under the headline 'Trust and partnership: towards a new vision for Europe's chemical industry' (CEFIC 2005).

Based on a preceding study 'Horizons 2015' (CEFIC 2004) which had emphasised the importance of the chemical industry for European Economies and the industry's current challenges, CEFIC had proposed the establishment of an advisory group on chemicals. CEFIC 2005 *extends this call for action to a concrete proposal of joint action in close collaboration with policy makers:*

> *"What we have in mind is a collaborative blueprint endorsed by policymakers and industry. This blueprint will identify the factors of success and will translate these into a number of concrete policy initiatives and actions with the Lisbon goals of sustainable growth and employment firmly in mind."*

The document argues that creating the right business context for chemical producers is essential for boosting European growth and employment and calls for the development of a shared vision between industry and policy makers. It addresses in particular a multitude of existing obstacles and the need to provide impetus for innovation and to improve framework conditions to encourage investments in new technologies in Europe. The association expresses its willingness to endorse analyses initiated by the Public Sector and its commitment to building trust with all stakeholders by ensuring transparency, engaging in positive dialogue and compliance[21]*.*

Under the headline Research and Science, this framework builds on already existing industry initiatives like the Sustainable Chemistry (SUSCHEM) technology platform which was instigated by the European Commission's ETP initiative and aims to stimulate innovation and to provide a long-range research agenda. As a reaction to upcoming technological and regulatory challenges, the association approved also significant additional funding for its long-range Research Initiative and launched an 'Innovative Science Award' to promote innovation in toxicology and ecotoxicology, two fields of particular concern to civil society under environmental and health aspects.

The opening statement of this document summarises this agenda:

> *"Policy makers and industry must start working together to develop a new strategic blueprint for the chemical sector. This will help further the EU's employment and growth agenda. Building trust is the first step in this process."*

- *Individuals*

  One of the most important forms of Private Sector involvement in research policy making is the membership of individuals from the Private Sector in advisory boards, steering committees, etc. Prominent high-level corporate representatives can contribute their research and management experience, evaluate Public Sector policy concepts from a Private Sector perspective and act as 'multipliers' which disseminate and promote shared policy objectives among their peers. In most cases, they are chosen because of their personal expertise and reputation, but they my also be delegated by Private Sector organisations. Depending on this, their perspectives and statements can be derived from their individual and corporate background or represent an 'official' industry perspective.

[21] For this purpose, an existing 'Trust and Reputation' Programme has been changed into the 'Build Trust' programme with redefined objectives: *"… the industry must demonstrate that it cares about society's concerns, it must seek to anticipate these concerns and it must develop common platforms for action."*

- *Charitable foundations*

  In some countries, not-for-profit organisations (e.g. Private Sector foundations) play an important role as research funding institutions. For example in the UK, the world's largest medical research charity funding research in human and animal health, the Wellcome Foundation, shows the important influence which such an organisation can have on research policy[22]. But overall, both the public/private nature of such not-for-profit organisations and the degree to which they promote and fund research varies considerably among ERA countries. And with some notable exceptions, the existing level of funds that are actually devoted by foundations to research in Europe remains low, compared to research contributions devoted by foundations in the US.

(4) Other stakeholders and social partners (e.g. NGO's, the media, citizens)

Research policy decision processes touch also frequently on other policy areas. Therefore they involve also other stakeholders. For example, political parties have a strong interest in research policies and are involved in their development. Other interest groups can also take an active part in the discussion. For example, Non-Government Organisations (NGOs) express their interests in environmental research. Or trade unions get involved in human resource related decisions.

Finally, the public and media may also exert considerable pressure in policy decisions.

Depending on the characteristics of the individual National Science and Innovation System, and on historically grown patterns, these stakeholder groups interact on a variety of levels and may lead to very complex overall structures (see Figure 5 for an illustrative example).

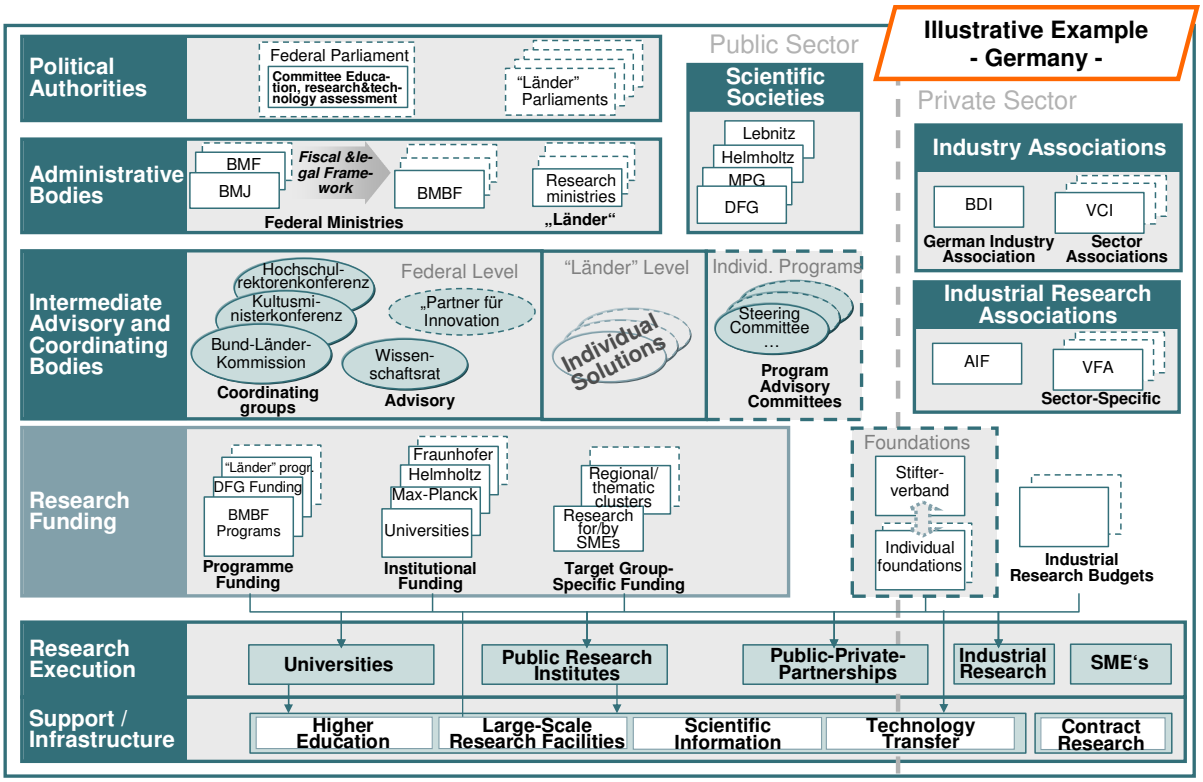

Figure 5: The complex German research policy 'landscape'

[22] For example they can increase the volume of research funds for fundamental, blue-sky research, for research in orphan areas and for early-stage applied research not sufficiently developed to attract industry funding in a long-term and coherent framework complementary to industry and government (See the report *Giving More for Research in Europe* (EC 2005g) for an in-depth discussion of the role of charitable foundations and the non-profit sector in boosting R&D investment and of measures and actions to promote this role).

2.2 Other intervening factors

Traditionally, the link between policy makers and stakeholders has been viewed as a linear process, whereby a set of findings, opinions and proposals is shifted from the stakeholders' sphere over to the policy sphere and then has some impact on policy makers' decisions.

Today, this overly simplified model has been replaced by a more dynamic and complex view which emphasises an interactive process, shaped by multiple relations and reservoirs of knowledge and influenced by various factors. The traditional Private Sector question "How can findings, opinions and proposals be transported to the policy sphere?" has been replaced by a more sophisticated view which tries to explore why some of the ideas that circulate in the research/policy networks are picked up and acted on, while others are ignored and disappear. This is determined by a combination of several important influencing factors, depicted in Figure 6.

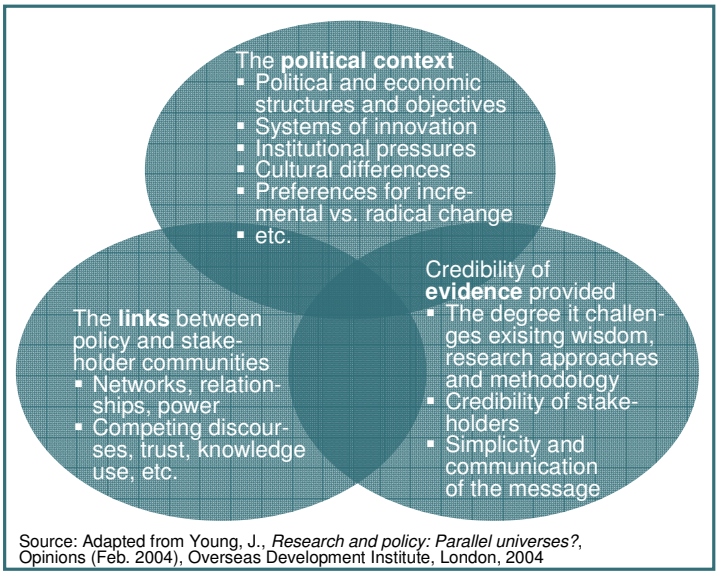

Figure 6: Important influences on policy decisions

Based on these general considerations, the findings of our study suggest that the nature and intensity of Private Sector interaction in research policy decision making are also functions of the characteristics of National Science and Innovation Systems and of other external factors:

- *Overall policy framework and underlying 'policy philosophy'*

  In the countries we analysed, research policy is governed by different overarching policy 'philosophies'. Some countries pursue a dedicated policy approach, sometimes with massive interventions, e.g. 'heavyweight' research funding programmes, etc. On the other side of the spectrum there are also countries with a minimalist approach, trying to reduce government intervention to the necessary minimum and/or focussing on creating favourable framework conditions with a maximum of 'room to move' for companies, entrepreneurs and other actors (As one of our interviewees stated: "Our foremost task is not to stand in innovators' and entrepreneurs' way").

- *National Science and Innovation governance profile*

  National profiles are too complex and diverse to derive a unified generic model of National Science and Innovation Systems, of research policy making and of Private Sector interaction therein. OECD 2003 differentiates between three generic archetypes[23]:

  - In 'centralised' governance structures with a strong top-down approach and a high share of institutional funding, research policy decisions are relatively straightforward and the important interfaces for Private Sector interaction are transparent.
  - In 'dual' governance structures, mixed systems of top-down and bottom-up approaches to priority setting, a mix of institutional and competitive funding instruments

[23] Note: OECD 2003 stresses that these archetypes are by no means a typology to categorise countries as belonging to one or another. Each country has elements that reflect aspects of each specific archetype. In analysing Private Sector interaction in research policy decision making, a mapping of such possible governance systems with observed characteristics is helpful to identify common patterns.

and research-performing institutions at several levels create a very complex environment for Private Sector interaction.

- 'Decentral' structures with relatively low top-down control and institutional funding favour a different type of Private Sector interaction, which takes place on a more regional and operational level.

- *Evolution of National Science and Innovation Systems and of economic structures*

  The development stages and structures of national economies and their Research and Innovation Systems determine R&D expenditure, research and innovation policies and related governance frameworks. For instance, nations with significant R&D expenditure in technology-intensive sectors are more likely to develop elaborate governance structures with sophisticated decision processes and Private Sector interfaces. In addition, research policy is not completely independent of and separate from technology and economic policies. To deal with this complexity, a variety of taxonomic approaches have been proposed to classify National Science and Innovation Systems[24].

  The literature suggests that National Science and Innovation Systems and economic structures go through an evolutionary process during which technology-intensive sectors gain importance and the linkage between Public and Private Sector becomes stronger over time. Furthermore, it is suggested that a threshold level of R&D investment to GDP may exist where R&D starts to have a strong impact on industrial structure (Park 2000).

  This has important implications for the involvement of the Private Sector in research policy decision making. We found in our study that a comparable evolutionary process seems to apply to this interaction. In a first step, a critical mass of technology and research intensive enterprises, committed to research policy interaction must be present to have a major impact on Public Sector research policies. Once this threshold is reached, a first generation of interaction approaches is enabled. This is also the start of a development process, in which the portfolio of interaction approaches is enlarged and more sophisticated instruments gain importance. Currently, the countries of the European Union are in very different stages of this process.[25].

- *Field of science / industrial sector*

  For the Private Sector, getting involved in Public Sector research and research policy is not equally attractive in all types of research. Commercial enterprises have a high interest in research areas with a direct relevance for their innovation and business activities, e.g. in the natural or engineering sciences. In contrast to this, research areas without an obvious short-term business impact (e.g. in the humanities) do not attract Private Sector engagement to the same extent. In addition, depending on their different potential to absorb research results and to collaborate in joint research activities, large, technology-intensive enterprises are in a better position to engage in Public Sector research and related policy debates than SMEs, especially if the latter are working in less technology-intensive areas.

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[24] Examples include the division into three categories: large high-income countries, smaller high income countries, and lower income countries (Nelson 1993), schemes consisting of large/rich countries, small/rich countries, and developing countries (Ratchford 1997) or of a high-productivity and high-activity cluster, a medium-productivity and medium-activity cluster, a high-productivity but low-activity cluster, and a low-productivity with diverse-activity cluster (Fagerberg 1988). Meissner 2001 proposes four categories, based on the structure of research expenditure as a function of types of research, funding sources and performing sectors. Other approaches try to include the internal characteristics of Science and Innovation Systems, e.g. Park's taxonomy (Park 1999) which proposes seven different clusters, based on the domestic flow of R&D expenditure among major actors, including government, universities, private firms, and non-profit organizations.

[25] Chapter 4.3 elaborates further on this evolutionary process as a basis for the classification of EU countries.

- *Position in the research and innovation chain*

  The interest and motivation of both the Private and the Public Sector to interact in the shaping and execution of Public Sector policy depends on the type of research performed. Along the research and innovation chain depicted in Figure 7, the objectives and results of research vary as well as the contributions which the Private Sector can make to research policy. Typically, the Private Sector will be increasingly interested in participating in Public Sector research policy the more its results are relevant for market-oriented corporate innovation activities. As a consequence, Public Sector institutions with research activities in applied research are usually more likely to attract Private Sector collaboration than those which focus on basic research.

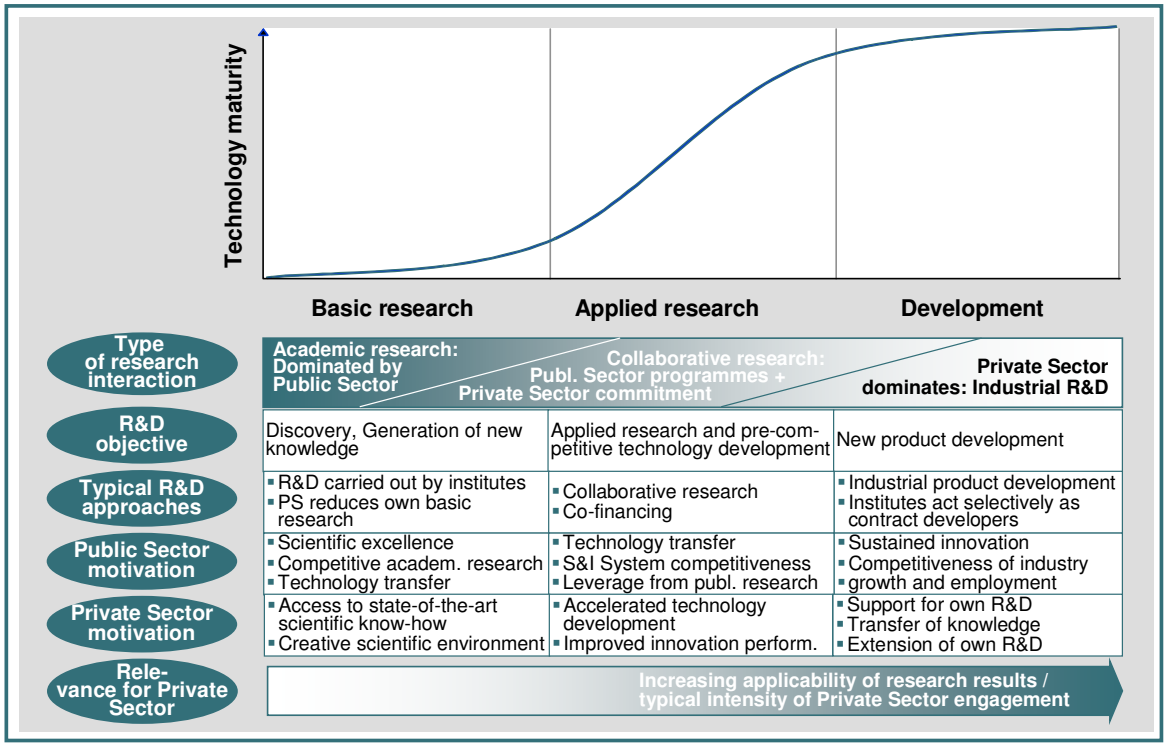

Figure 7: Determinants of Private Sector interaction along the research and innovation chain

- *Time horizon*

  The type of research policy decisions and the ways in which they are reached and implemented depend on the time necessary to define and implement them and to obtain feedback (see Figure 8). For example, research funding programmes with the objective of exploring new technology areas are often designed for durations of a decade or even longer. And only towards the end of this period will it become visible if their results are of relevance for the Private Sector and will it be possible to assess their likely socio-economic impacts[26].

  While Private Sector involvement in applied research and innovation issues has a long tradition in most countries, basic research has usually been the domain of Public Sector actors. However the traditional boundaries between fundamental basic research, applied research and commercial development have become less rigid. For example, Private Sector interest in basic research had faded when, during the 1980s and '90s industrial

[26] Typical examples include High Temperature Superconductivity (discovered in 1986 by Bednorz and Müller, Nobel Prize in Physics 1987, but until today without large scale industrial applications) and Fuel Cells (effect discovered in the 19th century, large commercial applications expected at the earliest for the second half of this decade).

companies downsized their corporate R&D departments under the cost pressure of global markets and refocused their R&D efforts on short term product development. Since then, industry has begun to re-appreciate early stage research as an indispensable source of new scientific results and technological know how. Hence many of them have developed a new interest in getting involved in (Public Sector driven) research as a means to strengthen links with Public Sector research and to ensure privileged access to relevant results. At the same time, Public Sector interest in involving the Private Sector is growing, driven by a growing demand for tangible contributions of Public Sector research to societal benefits, economic growth and the creation of new employment.

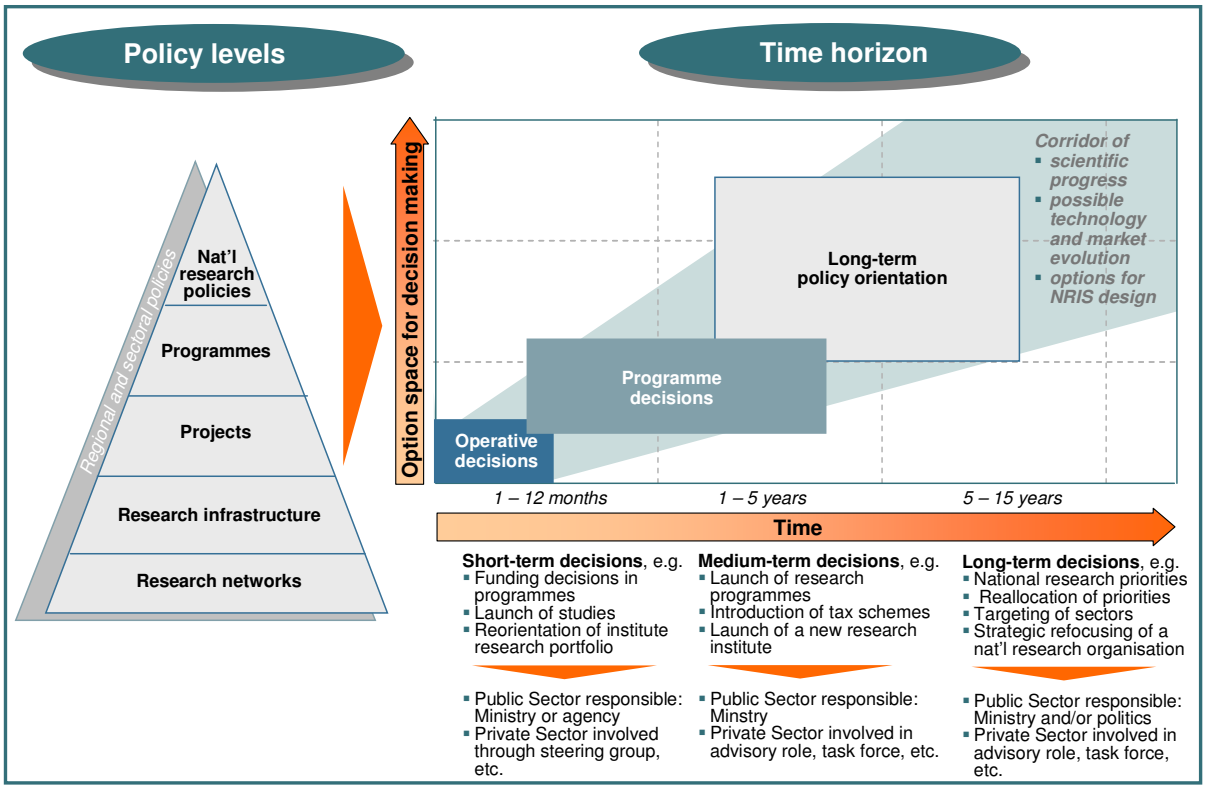

Figure 8: Time horizons of research policy and their influence on Private Sector interaction

- *Policy level*

  Research policy is defined and implemented at different levels (see Figure 9). Typically, at the top of the pyramid, National governments define national priorities and frameworks. This forms the basis for a second layer, where priorities are converted into individual programmes, usually by responsible ministries with the help of agencies, etc. On a third, operative level, the actors define and pursue their institutional research policies/strategies. Other relevant special policy domains, e.g. the development of Public Sector research infrastructure, complement this picture.

  This straightforward structure can be complemented by regional and/or sectoral policy levels. For example, the states of a federation – and not the federal government! – may be responsible for higher education institutions. As these states can also fund research through their own programmes, manage their own research institutes, etc., this can create an important additional research policy level which sometimes overlays the national level. The boundaries and interfaces between these two often have historical roots.

- *Type of policy and instrument(s) used*

  Once overall research policy objectives are set, individual research policy domains may develop different types of decision processes. In many countries, direct instruments (e.g. research funding programmes) form the 'core' of research policies. Decision making is

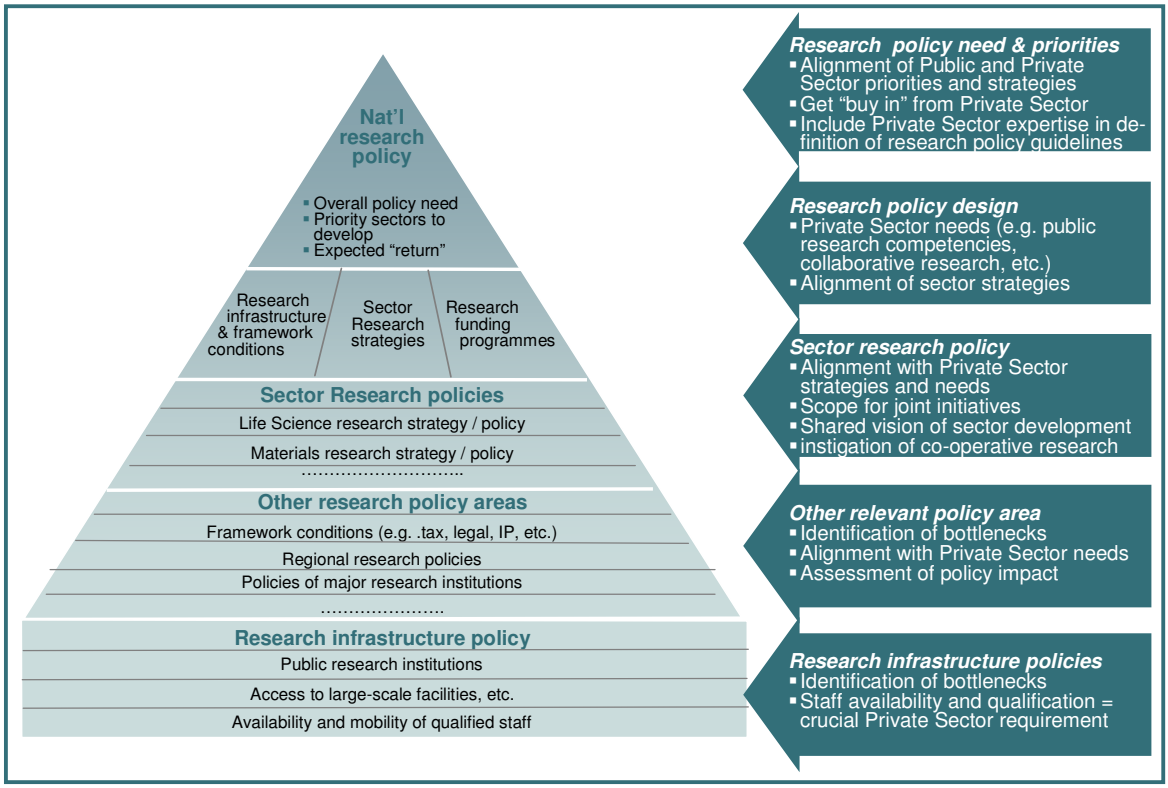

Figure 9: Research policy levels and issues of shared interest

rather centralised, driven by responsible ministries and agencies. In an advisory role, the Private Sector can make important contributions to the instigation, design and launch of such policies as well as of 'indirect measures' (e.g. tax schemes). However in some countries, the number of actors involved on the Public Sector side in research policy (often including several departments of research ministries, in some countries also other ministries, coordinating and advisory bodies, agencies or regional authorities) and intersections between research policy and other policy domains (e.g. economic, fiscal[27]) can create additional complexity, making it more difficult for the Private Sector to identify and reach all relevant decision makers and to position its advice, perceptions and needs appropriately in the decision processes. In such cases, there is a need for improvement and streamlining of inter-ministerial decision processes and interfaces.

- *Target groups for Private Sector interaction*

  The Private Sector consists of individual companies whose objectives, needs and the potential to participate efficiently in research policy decision making can vary considerably, for example according to the size of the enterprise. Furthermore it is necessary to differentiate between research intensive and less research intensive sectors. The interests of these companies are represented by industry-wide, sector-specific and other associations. In addition, charities play a special role as R&D funding institutions in some cases.

  Each of these Private Sector sub groups may be suitable for and interested in different types of interaction, thereby requiring different levels and approaches[28].

[27] The number and importance of such interfaces increases for example if federal and regional policies intersect or if the traditional portfolio of instruments is extended, e.g. through fiscal incentives (which gain importance, as the OECD Science, Technology and Industry Scoreboard 2005 states: '*An increasing number of countries use R&D tax concessions to encourage business R&D expenditure. Today, 18 OECD countries have R&D tax credits in place, 50% more than in 1996. Canada, the Netherlands and Italy focus on small firms, while others do not distinguish by size…*' (OECD 2005b).

[28] This issue is further elaborated in Chapter 2.1 (See page 24 ff.).

3. Approaches and instruments for Private Sector interaction in research policy decision making

3.1 Overview

Table 2 summarises over 30 approaches and instruments for Private Sector interaction which we have identified in our analysis.

Type of interaction	Objectives	Typical instruments	Current use	Initiated by
Networking and general discussion	▪Build relations and networks ▪Create visibility and favourable climate ▪Develop mutual understanding and trust ▪"Radar" function: Early identification of hot issues ▪Low-level exchange to test potential priority issues	▪Informal personal contact (Ad hoc or regular)	▪Frequent	▪Both sides
		▪Regular meetings	▪Frequent	▪Both sides
		▪Mutual invitations	▪Selective	▪Both sides
		▪Conferences	▪Selective	▪Typically Public Sector
		▪Discussion platforms	▪Occasional	▪Typically Private Sector
		▪(Thematic) networks	▪Frequent	▪Typically Public Sector
		▪Staff mobility and knowledge transfer	▪Occasional	▪Both sides
		▪Published information	▪Occasional	▪Both sides
Awareness, commitment and influence	Get a broader community interested and involved in ▪identification and evaluation of research policy issues ▪collection and communication of information as inputs for research policy making ▪making stakeholder positions vis-à-vis research policy issues explicit	▪Awareness campaigns	▪Occasional	▪Public Sector
		▪Foresight exercises	▪Occasional	▪Public Sector
		▪Ad hoc meetings and workshops	▪Selective	▪Both sides
		▪Ad hoc Studies	▪Selective	▪Both sides
		▪Position papers	▪Frequent	▪Private Sector
		▪Public statements (press conferences, articles, etc.)	▪Frequent	▪Private Sector
		▪Lobbying	▪Frequent	▪Private Sector
Advice for policy makers	▪Contribute to understanding of situation, possible implications and policy need ▪Identify policy options ▪Provide opinion and advice on policy issues ▪Express and consolidate stakeholder perceptions ▪Support for own positions	▪Ad hoc consultations	▪Frequent	▪Both sides
		▪Continuous consultative role	▪Frequent	▪Typically Public Sector
		▪Internet consultations	▪Occasional	▪Public Sector
		▪Expertise	▪Frequent	▪Public Sector
		▪Ad hoc advisory groups	▪Selective	▪Public Sector
		▪Individual advisory role	▪Occasional	▪Public Sector
		▪Advisory committee	▪Frequent	▪Public Sector
		▪Unsolicited advice	▪Selective	▪Private Sector
		▪'Think tanks'	▪Occasional	▪Private Sector
Research policy (co-)design, decision making & implementation	▪Contribute to policy formulation (to ensure relevance and efficiency from stakeholder perspective) ▪Influence the direction and implementation of research policies ▪Enhance joint research and value creation through shared responsibilities ▪Co-formulate and co-implement research policies in shared areas (e.g. research and innovation clusters)	▪Impact assessment	▪Occasional	▪Public Sector
		▪Steering committees	▪Frequent	▪Public Sector
		▪Evaluations	▪Frequent	▪Public Sector
		▪Board memberships	▪Frequent	▪Public Sector
		▪Policy task forces	▪Selective	▪Public Sector
		▪Innovation Platforms	▪Selective	▪Public Sector
		▪(Operative) joint decision making	▪(Frequent in clusters, etc.)	▪Both sides
		▪Delegated implementation	▪Occasional	▪Public Sector
		▪Operative support	▪Occasional	▪Public Sector
		▪Private Sector research funding	▪Frequent	▪Private Sector
		▪Charitable foundations	▪Occasional	▪Private Sector

Table 2: Overview of approaches and instruments for Private Sector interaction[29]

[29] Source: Own analysis. Table 2 builds on the categories used for collection of data for country profiles and develops them further to this comprehensive description.

These approaches are grouped into four categories[30]:

(1) Approaches and instruments to stimulate networking and general discussion

These build the foundations of an efficient interaction. They make the actors and their opinions visible for each other and support the establishment of contact and relations between them. They are also essential for developing the necessary positive climate and communication culture which is a necessary prerequisite for mutual understanding and trust. Another important possible benefit of this type of general communication which is not driven by actual requestor 'burning issues' is a 'radar' function: Regular low-level communication can help to identify potential future issues early and provide an opportunity to gain an advanced understanding of the other side's perceptions and to sensitize them for own opinions. Part of such discussions can also be a consensus on which research policy issues merit special attention and should become subject to in-depth discussions.

(2) Approaches and instruments to create awareness, commitment and influence

To achieve leverage from interaction, there must be a critical mass of actively involved stakeholders which represent the opinions and needs of stakeholder subgroups (e.g. large industry vs. SMEs, different sectors, etc.) in a balanced way. Own positions must be transparent for the other side and clearly communicated. For this purpose, at this stage

- policy makers and Private Sector have a common interest in mobilising a broader community of stakeholders (e.g. Private Sector actors with no or limited current awareness of the benefits of Public Sector research and related policy making involvement).
- necessary information and data must be made available as inputs for policy making and/or as support for the expression of stakeholder positions;
- the other side's interest must be drawn to research policy issues of (potential) importance.
- own positions must be clearly communicated and the other side's positions must be understood.

Where appropriate, a complementary task at this stage can also be to sensitise policy makers for the need to enhance Private Sector involvement in research policy making and for the benefits of doing so.

(3) Approaches and instruments for advice to policy makers

Once research policy instigation or definition are under way, it must be ensured that the Private Sector can contribute in an appropriate way to the understanding of situation, possible implications and policy need, the development of solutions and the creation of the necessary consensus to implement policy measures successfully. This includes

- the identification of policy issues, their positioning as a subject for interaction and their delivery in an appropriate form;
- the consolidation of individual perceptions, for example to ensure that the Private Sector 'speaks with one voice';
- the provision of advice to policy makers;
- the availability of a 'sounding board' for new ideas and proposals; and
- mutual communication and constructive discussion of individual positions.

(4) Approaches for research policy (co-)design, decision making and implementation

Even if Chapter 1.2 confirms that the ultimate responsibility for research policy formulation and implementation is with the Public Sector, the Private Sector can be involved in

[30] See description in Chapter 3.2 and detailed profiles in Appendix A3

these steps also in a way where he assumes a certain degree of co-responsibility. This can help for example to ensure their relevance and efficiency from a stakeholder perspective and contribute to acceptance and achievable leverage. The following objectives can drive this form of interaction:

- Integration of Private Sector contributors in policy formulation and implementation processes to ensure efficient use of Private Sector know-how and perceptions and to build necessary bridges;
- Alignment of Public and Private Sector policies/strategies in cases where joint action is necessary to achieve progress and where this is supported by shared objectives, for example in cases where research efforts are closely linked to economic growth and creation of employment and a major joint initiative is necessary to convert scientific progress (Driving force: Public Sector research) efficiently into economic success (Driving Force: Industry and/or SMEs).
- Securing of competitive and stable research and innovation capabilities and capacities (for example through appropriate funding)
- Improvement of the efficiency of research and innovation though necessary support (for example for SMEs to improve their own scientific and technological knowledge base or to enhance their use of support/transfer from Public Sector research).

It is important to note that these approaches and instruments should not be considered as stand alone solutions! Public Sector - Private Sector interaction is not a linear process. Successful examples are often based on a combination of more than one approach and/or instrument, characterised by their intelligent and pragmatic use and adaptation to specific needs, national/regional policy, cultural background and sometimes even to the organisations and individuals involved. Therefore, our analysis describes a broad spectrum of approaches and instruments. These have often evolved "organically" over time (and not as a result of a planned process) and include important elements of informal interaction.

The following sections provide a brief description of these approaches and instruments[31].

3.2 Brief description of identified approaches and instruments

3.2.1 Networking and general discussion

The foundations of all successful forms of interaction are laid by the establishment of sustained relationships and networks in which the actors involved in research policy making get acquainted with each other and build mutual understanding and trust. For this purpose, usually a durable general dialogue is established among key actors, in which they exchange regularly on perceived situation and issues. Typically, this general dialogue plays also an important role in the preparation of more formal, issue-driven discussions and the preparation of decisions at an early stage.

For this purpose, the following mechanisms and instruments are used:

- *Informal personal contact*

  Established and functioning personal relations between the key individuals on the Public and Private Sector sides seem to be vital for efficient interaction in research policy making. There is no general archetype of this kind of relationship, because its form and the extent to which it is used depend very much on the communication culture and 'rules of the game' in the specific country and policy context. But in general, a constructive and cooperative atmosphere which stems from this type of personal contact proves to be very supportive in the issue driven and problem-solving oriented forms of interaction described in the following paragraphs.

[31] For details see Appendix A3.

Very often, networks are the starting point for interaction on a personal basis. For example, in some countries alumni organisations of higher education institutions play an important role. These relation can then be maintained on an 'ad hoc' basis ("…We call each other when an issue comes up…") or on a regular basis ("…We meet every .. weeks to exchange our views").

Mutual trust is an underlying key feature of such relations and an important enabler for collaborative behaviour in more intense types of interaction ("…The other side knows that we are not playing games…").

- *Regular meetings*

  Regular meetings extend informal relations to more or less "official" get-togethers with a quasi formal character. They provide a reliable platform for mutual information and for exchanging actual positions without the pressure of having to solve specific 'burning' issues. Typically this happens at the working level, but can also take place between high-level decision makers if there is a mutual interest.

  Such meetings take the form of bilateral or multilateral meetings, either of a 'jour fixe' type (on a regular basis) or of an 'ad hoc' type (as needed).

- *Mutual invitations*

  Research policy issues are usually discussed at internal meetings of policy institutions, industry associations, etc. As they are often of high relevance for the other side, the outcome of these meetings is re-discussed subsequently with them in external meetings. To improve this process and to make the communication more interactive, some pairs of policy making institutions and Private Sector institutions have developed a culture of mutually inviting each other to such events.

  The inviting party takes the initiative and identifies issues for joint discussion. The invited party joins the meeting, prepares its own contributions and reports back to its institution. This can happen in the form of regular mutual invitations, for example to internal routine meetings, or as 'ad hoc' invitations, when hot topics come up. Participation can be for the whole meeting, but is usually limited to topics of shared interest.

- *Conferences*

  In some countries, public conferences are used extensively to discuss the status of important research programmes, to obtain immediate feedback from participants and to create additional awareness. This type of event, often positioned as a milestone event during the lifetime of a research programme, targets actual or potential participants, technology and market experts, etc.

  Another important platform for research policy making and Private Sector interaction therein are conferences where actual research policy issues are discussed[32]. These conferences target decision makers and experts involved in research policy making.

  Both types of event typically provide excellent platforms for Private Sector interaction, because they enable immediate feedback and discussion, permit the dissemination and testing of advanced concepts and help to identify and solve controversial issues. In addition, they often reach an audience which would not participate in more formal events.

- *Discussion platforms*

  A space for very open exchange of views among selected peers from both sides can be provided by special discussion circles, hosted by a high-level institution. Usually participation is limited to a smaller number of key individuals on a peer level. This provides an 'open space' for free discussion, testing of new ideas and joint learning.

[32] For example, several national governments have organised such conferences in close collaboration with OECD as high-level events with a very high international visibility.

In some current examples, existing circles of Private Sector actors have extended their interest to the research policy domain and have taken the initiative to make this a topic for their events and to ensure participation of their peers from the Public Sector.

- *(Thematic) networks*

  Public Sector-initiated and -sponsored networks (e.g. thematic communities in a specific research area, regional research and technology clusters) represent 'Communities of interest' gathering around a specific topic with a high interest in research and related topics, including research policy. Such networks bring together research institutions, technology companies, financial institutions, etc. They are also particularly suitable to involve SMEs, which are otherwise difficult to reach. As a result, a very efficient interaction among these actors takes place at the level of operative research issues which concern them directly.

- *Staff mobility and knowledge transfer*

  Very often, the Public Administration and commercial enterprises represent different worlds with separate languages, problem solving attitudes, etc. To overcome this gap, more transparency and fluidity between both sectors on a personal basis is desirable. One way to achieve this is to stimulate the fluidity of staff between the Public and the Private Sector.

  Ways to achieve this can include for example

  - involvement of senior Private Sector staff in research and teaching activities (for example as visiting professors with an industry background working part time for universities, sometimes funded by their own company);
  - formal (temporary) staff exchange programmes between ministries/agencies and Private Sector institutions[33];
  - moves between positions held in Public Sector institutions and in Private Sector enterprises or organisation as part of personal career paths;
  - hiring of executives with industry background into public research board, directors' or institute/faculty leadership positions.

  All of these options have the merit of extending and intensifying personal and institutional networks, of developing better mutual understanding and of supporting the acquisition of complementary competencies and skills through the temporary or long-term engagement of staff from the complementary sector. But they differ in their degree of formalisation (e.g. staff exchange programmes between institutions, etc.), the level at which they take place (institutional, personal) and the reasons and driving forces of the involved institutions. A common feature is the necessary high personal motivation (often beyond formal or financial incentives) for leaving the 'own sphere' and getting exposed to the other side's (often extremely different) formal and informal structures, processes, formal rules and attitudes, for example if a public servant goes on a temporary assignment in a commercial enterprise or vice-versa.

- *Published information*

  Research policy debate can also be triggered and fuelled by regular information about research policy perceptions, issues and proposals which the stakeholders disseminate to a broad audience, for example in the form of newsletter, Internet presence, etc.

  This instrument is used to inform a broad audience about own perceptions actual ideas and needs and to stimulate a public discussion. Beyond its informative function, this instrument is often combined with elements of mobilisation of a broader audience in support of own objectives (which is described in chapter 3.2.2).

[33] A forthcoming report, commissioned by DG Research, will explore this issue further. See also the UK Office for Science & Innovation's Knowledge Transfer Partnerships (www.ktponline.org.uk).

3.2.2 Awareness and commitment

A second key success factor of Private Sector interaction in research policy making is that all actors are involved appropriately and have the means and occasions to express and communicate their perceptions and needs accordingly. For this purpose, both sides use the following set of approaches and instruments:

- *Awareness campaigns*

  In a variety of countries, policy makers have used successfully information days, 'road shows' and seminars and other measures to create awareness in order to get a broader audience and/or specific target groups interested and involved in research policy initiatives. This approach is used for example to promote research and its results in a general way, but also to raise awareness of technology transfer possibilities for SMEs or to inform them about new research funding schemes and to encourage them to apply for those.

  The use of this type of approaches started in many countries with centrally organised campaigns. But in recent years a new generation of awareness-oriented approaches attempts increasingly to bring them 'closer to the customer' on the basis of local events and a strong involvement of local institutions.

- *Foresight*

  Foresight studies have gained importance in recent years[34]. The OMC working group on 'The Public research base and its links with industry' had already highlighted the importance of foresight studies: "*…an important exception to lack of initiatives in relation to Private Sector involvement in policy formation (but on a broad level) are the national, regional and sectoral foresight programmes that have formally sought to include industry participation within these policy shaping programmes*" (CREST 2004b).

  Typically they are organised as highly interactive exercise, involving all stakeholders in a broadly based initiative to

  - identify and assess potential research areas, technology trends, etc.;
  - obtain feedback from a broad audience of stakeholders and experts; and
  - direct the attention of stakeholder groups to research policy priority issues and gain their commitment.

  Foresight studies can be used in different ways:

  - The objective of large, nationwide exercises is typically to identify major global scientific or technology trends and to assess their importance and expected impact. A complementary objective can be to identify improvement needs for the National Science and Innovation System and to gain broad stakeholder commitment to necessary changes. Such exercises are usually organised by national governments and involve a broad audience and top-level stakeholder representatives.
  - Targeted foresight exercises aim at the mobilisation of specific sectors. Their objectives are often similar to the ones previously described. But they target a smaller, highly specialised audience and their focus is more narrowly focussed on specific research or technology areas where they go more into depth.

  Foresight studies achieve their full leverage if they do not remain stand-alone one-time exercises. As the example of the French Futuris foresight exercise on the following page illustrates, they can serve as the starting point for mobilising a broad array of stakeholders, for launching profound scientific development and governance change initiatives and for developing and extending informal or institutionalised networks of stakeholders.

[34] For an oversight over current Foresight activities in the EU, see EC 2006a and literature quoted therein.

Case study Futuris: National foresight exercise to induce reforms

With the emergence of changing research, innovation and industrial policy paradigms, there was a growing concern among policy thought leaders whether the French research and innovation policy and its current governance framework needed a fundamental rethink. Would the French Science and Innovation system (characterised by one of the highest proportions of public GERD in the EU, combined with highly centralised but at the same time complex governance structures with a multitude of actors) be able to adapt and react efficiently to the challenges of increasingly global competition and of meeting Lisbon and Barcelona objectives?

Backed by a broad consent from other policy makers and stakeholders, the ANRT[35] took the initiative in 2003 and proposed the 'Operation Futuris'. The objective was to analyse the major forces and trends influencing the French Science and Innovation System, to identify its strengths and weaknesses and to define scenarios and options for the time horizon 2015-2020. An important underlying issue was the conviction that an initiative targeting potentially profound changes would need broad acceptance to be able to break the ice and induce fundamental reorientations. Futuris was expected to contribute a systemic vision of possible directions and their driving forces as basis for a general reorientation of French STI policy.

For this purpose, a three years national foresight exercise was organised under the auspices of ANRT, supported by the prime minister. Co-financed by ANRT and industrialists, Futuris offered a unique platform for debate and analysis, involving a multitude of public and private research and innovation actors. This was the first time that a foresight exercise with such a systemic approach and strategic dimension took place in France in the following two phases:

- A first phase which involved over 250 actors in various working groups had to develop scenarios for the future evolution, based on identified key determinants for the French Science and Innovation System in the period 2003 - 2004. An additional important result of this first phase was a consensus about the need for reforms. The French system was described in a Futuris report as follows: *"…centralised, of limited reactivity and compatibility with the emerging European Research Area, the French NIS does not have today the means to reach its expressed ambitions. A global reform is necessary.*"
- The second phase extended this discussion to an in-depth analysis of research and innovation issues in key sectors in view of their importance for French economy and their interdependencies. The results were an important input for an overarching process to define development directions for French research, initiated by the responsible ministry. As a result, a portfolio of sector studies and recommendation for the re-orientation of the French National Science and Innovation System were available by the end of 2005.

Futuris went into depth in eight thematic key areas: Sectoral driving forces, trends and options, French Science and Innovation System governance, the organisation of Public Sector research, human resources, Public-Private-Partnerships, attractiveness of France as a research location, the employment of doctors and the development of innovative enterprises.

An evaluation of Futuris, published in December 2005 concluded that Futuris has been successful so far and has especially four merits: The generation of a reference framework as basis for cooperative analysis, the reinforcement of the link between research and innovation, valuable prospective analysis as a reliable basis for discussion and scenario development and a high level of awareness among stakeholders and public. This success was based on the quality of moderation, appropriate financial support, efficient and lean process management and the assembly of a large, representative portfolio of participants.

But it was also stated that "… the construction site is far from being completed." In the future, it was proposed that Futuris should be maintained as a platform for discussion, benchmarking and in-depth analysis, accompanying the targeted change process.

[35] 'Association Nationale de la Recherche Technique', a national 'think tank' which gathers representatives of companies, public research and ministries, supported by the French government.

- *Ad hoc meetings and workshops*

  To solicit experts' and stakeholders' opinions about research policy issues and to discuss situation, challenges and options, policy makers invite to expert meetings or workshops with stakeholder participation. Such events are used by policy makers for example to identify and assess emerging research areas and research policy needs; or for 'low level' testing of emerging ideas about new research or policy areas. Usually these are limited one-time efforts. The results are used by policy makers to define follow up if appropriate. But if the outcome justifies this, they can also become a first step to ignite a more intense discussion about perceived priority issues.

- *Ad hoc studies*

  To identify and evaluate emerging scientific fields or technologies, or to analyse and justify research policy needs, policy makers or stakeholders often initiate Expert studies. Usually, these are commissioned by stakeholders or policy makers and carried out by independent experts or consultants.

  The objective of such ad hoc in depth investigations is to

  - create insights into potentially important policy areas and a rational database for discussion;
  - raise important issues and to develop first positions; and to
  - create awareness for research policy issues and put them on policy debate agendas.

  Again, such efforts only create their full desired leverage if they serve as starting point for follow-up activities and do not remain a one-time exercise.

- *Position papers*

  Stakeholder positions expressed in 'white papers', formal memoranda or equivalent extend the study approach to a strong, explicit statement of opinion, usually including recommendations. Often they build on insights from studies, but include a more direct call for action in a direction which the proposing stakeholder thinks is appropriate. This effort can be further backed if such position papers are launched in a highly visible way, for example accompanied by press statements, etc. where appropriate (see next point).

- *Public Statements*

  A more indirect form of conveying stakeholder opinions and recommendations are public statements, e.g. press conferences, articles, Internet, etc. Yet, this way to communicate can be a powerful one if it succeeds to create broad awareness and to mobilise public opinion.

  But this instrument should be used with caution. If conflicting public statements escalate to public wars of opinion, this can backfire and become a heavy burden for cooperative and trustful problem solving interaction modes!

- *Lobbying*

  A widespread form of interaction, used especially by the Private Sector is lobbying. Corporate or industry research policy activities can be embedded in such a broader lobbying context (together with other policy areas). Individuals or organisations specialising in policy relations act as intermediaries to

  - gain access to key decision makers;
  - position opinions and proposals;
  - influence decision making.

  Such activities are often part of the duties of industry or sector associations. Some of these maintain own working groups on research and research policy issues to help to align the Private Sector opinions and to prepare official statements. But these messages

can also be prepared and/or conveyed by specialised lobbyists or – in the case of large enterprises – by specialised corporate departments for research policy and related issues.

3.2.3 Advice

In our interviews, many representatives of both the Public and the Private Sector emphasised the importance of Private Sector expertise in this process. Both sides have a strong motivation to interact and use a variety of approaches and instruments for this purpose:

- *Ad hoc consultations*

  Ad hoc consultations with the Private Sector and with other stakeholders and experts are initiated by many policy making institutions to obtain expert views and/or stakeholder opinions as input for policy instigation and formulation if an important issue occurs. This can take different forms, including for example in the form of workshops initiated by the ministry in charge.

- *Continuous consultative role*

  In a growing number of cases, the consultative role of the Private Sector and of other stakeholders and experts is extended to an ongoing dialogue. This can take place in different forms, ranging from formal parliamentary hearings, where Private Sector and other stakeholder representatives are invited regularly to provide their views on research and innovation policy issues, to regular informal meetings, where for example ministries and Private Sector associations invite each other to participate in their internal working group discussions on relevant matters.

- *Internet consultations*

  In the preparation of certain research policy decisions, it is desirable to capture the opinions of a broader audience than can be captured with conventional consultation approaches. Therefore certain policy makers have used recently Internet consultations, where a questionnaire is published on the Internet which can be filled out and returned by any interested party. This is an invitation to a broad audience to express their opinions on specific policy issue.

  The advantage of this concept is that it is easily accessible for any interested party and provides a large sample of perceptions with high transparency if the necessary quantity and quality of responses can be assured. The quality and the representativity of responses is a major challenge, since an open Internet consultation provides no guarantee that the desired target respondents will reply. Furthermore, there is a danger that the debate could be taken over or biased by lobbying minorities.

  Because of their specific benefits and limitations, Internet consultations have been used so far mostly as a complementary element of more comprehensive policy formulation exercises, for example to test the acceptance of draft policy concepts in a broad audience.

- *Expertise*

  Expert statements, testimonies or written expert statements are frequently used by policy makers to complement available knowledge which is necessary for making sound decisions. The difference with consultations is that the role of experts (independent, from the Private Sector or from another stakeholder group) is limited to providing information. This input is used by decision makers, but the expert is not part of the discussion of options, criteria and possible implications.

- *Ad hoc advisory groups*

  In the course of policy formulation, an ad hoc need for advice may occur. In response to such a need, a non-permanent advisory group can be assembled to advise research policy makers on ‘burning issues’. This is organized on an ‘as needed” base’, usually in the form of one-time expert advisory meetings. Such ad hoc advisory groups involve usually experts and/or high-level representatives from all stakeholders. But given the limited life-

time of the issue on which they advise, their duration is also limited to a single meeting or a limited number of meetings, concluded by a final report or equivalent.

- *Individual advisory roles*

  In some countries, the leading political decision makers seek the personal interaction with their counterparts in the Private Sector (or with former high-level industrial decision makers or equivalent) on a peer-to-peer base. The objective is to get immediate open, direct and critical feedback and to be able to discuss ideas and advanced concepts among equals.

  This type of advisory or consultative relationship can also have elements of coaching and takes typically place on a very personal base, either face-to-face or in high-level discussion rounds. It focuses on policy directions and on broad policy guidelines.

- *Advisory committees*

  Many countries have established institutionalised groups of experts and stakeholders to provide formal advice to policy makers. Form, topics discussed and intensity of use of such advisory bodies vary. But they have several characteristics in common:

  - typically composed of high-level representatives of stakeholders (Strong Private Sector representation);
  - explicitly formulated areas where advice is expected;
  - close interaction with policy decision makers;
  - in many cases operative support ensured (e.g. by dedicated support structure).

  Private Sector representatives are among the best-represented stakeholder groups in such committees, providing often up to half of the members and above, depending on the research policy areas covered.

  Traditionally, such advisory committees were in a pure advisory role (i.e. with no obligations for policy makers caused by advice provided). To avoid that such advisory bodies remain 'tigers without teeth', some countries have begun to institutionalise and empower them. This includes for example (legally) defined rights of the group to request information, own administrative and expert support structures and obligations for political decision makers and Public administration to react to statements of the advisory group.

- *Unsolicited advice*

  In cases where Private Sector (and maybe also other stakeholders') advice is not sought by policy makers, these stakeholders can also submit advice which they consider appropriate on their own initiative. This can take for example the form of written recommendations (e.g. letters) or face-to-face personal communication (usually between top level-decision makers).

- *'Think tanks'*

  The use of independent organisations which provide expertise and advice for policy making is common in many policy domains. Such think tanks create innovative policy solutions, participate in policy debates and are expected to play a special role in the critical assessment and advance of existing policy frameworks as 'out-of-the-box' thinkers. To secure their competency and independence, they have their own organisation and resource base, including long term financing.

  In recent years, such 'think tanks' have also been initiated and financed by the Private Sector. This has been the case in countries and situations where technology-intensive companies feel a particular need to ensure favourable framework conditions and the necessary support from a competitive National Science and Innovation System. For example, the 15 biggest companies of the Swiss manufacturing sector have joint forces to initiate and fund Avenir Suisse, an institution to make leading-edge contributions to national research, technology and economic policy design. Other examples include privately

funded charitable foundations which take this role to act as a provider of innovative ideas and as 'devil's advocate' to promote innovation in research policy governance.

3.2.4 Research policy (co-)design, decision making & implementation

Chapter 1.4 had described that there is a broad consensus that Public Sector research policy decision making is the sole responsibility of policy makers. They are responsible for the contents and effects of research policies and for the decision processes which lead to them. However, this is not an insurmountable barrier. There is also a zone of interaction in decision making itself, covered by the following approaches:

- *Impact assessment*

  When formulating research policies, it is essential for decision makers to understand the implications of their policy proposals (Typical questions include: Will desired effects really occur to the desired extent? Can undesired side effects occur which offset the expected leverage? etc.). Some of these questions are of high relevance for the Private Sector and/or are directly linked to Private Sector corporate behaviour, for example: "… If we introduce tax incentives for research, (1) will they stimulate Private Sector R&D investment to the desired extent? Will this happen in the right sectors? Will it reach the important target groups (e.g. SMEs)?

  Obviously, the Private Sector itself has a much better understanding of the motivations and decision criteria of his members. Therefore, some research policy makers seek increasingly to obtain immediate Private Sector feedback in their policy design process in the form of impact assessments. A typical example is again the design and refinement of a tax incentive policy for research: Once policy makers have drafted a proposal, Private Sector actors can model its impact. Based on this feedback, corrective action can be taken in the policy measure design if necessary. This approach can help considerably to enhance the appropriateness of research policy measures[36]. But it requires also a highly collaborative, open and trustful working mode between both parties involved.

- *Steering committees*

  One of the standard forms of Private Sector involvement in research policy related decision making are steering committees. Such institutionalised groups accompany for example major research programmes and provide advice to programme management. In some cases this advisory role is even extended to a co-decision function.

  Typically such a steering committee consist of a mixed group of stakeholders and policy makers. A strong Private Sector share in the participants group is not unusual.

- *Evaluations*

  Evaluations are used extensively by policy makers as standard tools to assess the efficiency and effectiveness of research and innovation policies. But they do not only provide an evaluation of past achievements. They are also used as a starting point for assessing follow-up policy needs, for designing next generation policy measures and for identifying objectives and priorities. They might also reveal that a measure is no longer needed (especially in the case of temporary market or system failures).

  Traditionally, Private Sector actors have been involved in such evaluations either as participants in the evaluated research policy programmes (e.g. through interviews, questionnaires, workshops, etc.) or as members of expert or steering groups which accompany the evaluation study.

  An intensive Private Sector interaction becomes also important if the results of such an evaluation are used as the starting point for a research policy revision. For example, the

[36] See for example the UK consultation on fiscal measures (http://archive.treasury.gov.uk/siteindex.html)

German research ministry BMBF uses frequently mixed working groups with policy maker and stakeholder participation immediately after the final presentation of evaluation findings to work out proposals for next generation policies on this basis.

- *Board memberships*

  Another trend we observed during our analysis is increasing interest of Public Sector research institutions to acquire senior Private Sector representatives as board members[37]. In some cases, former industry research executives occupy even top management positions in such institutions.

  This type of involvement implies that the Private Sector representatives assume a certain degree of responsibility for research policy decisions. But this has advantages, e.g.

  - access to know-how and personal/institutional network of Private Sector members (often complementary to those of senior staff with a Public Sector research history);
  - immediate feedback on relevance and appropriateness of research policies and strategies from a Private Sector perspective;
  - Private Sector board members can act as multipliers in the promotion of skills and the development of working relationships.

- *Policy task forces*

  A collaborative approach to research policy formulation can be appropriate if Public and Private Sector have shared or complementary objectives in specific research areas or sectors. For example, a strong public research base and an innovative Private Sector work hand-in-hand to securing the innovation performance of the pharmaceutical and life science sector for mutual benefit. In such a case, working together to formulate policies which support both sides' objectives and ensure seamless research and innovation chains is attractive.

  A form of collaboration which has evolved for this purpose are policy task forces where policy makers and Private Sector representatives work together to formulate draft policies, empowered by a government mission. This is an efficient way to assemble the necessary expertise, to create a shared vision and to gain 'buy in' from stakeholders already during the policy drafting.

  A typical form of this type of interaction is a temporary task force. If appropriate, this can be extended to a longer duration or institutionalisation if appropriate.

- *Innovation platforms*

  One of the limitations of advisory boards is that they have to rely on other institutions to implement their recommendations. Innovation platforms have evolved as a way to overcome this by establishing a complementary platform focussing on the conversion of ideas into action. To achieve this, innovation platforms work in an agenda-setting, decision- and implementation-oriented mode. They assemble a group of high-level decision makers (usually from politics, public administration and the Private Sector) who have the necessary influence to induce action on their sides. In some cases, they can even make credible commitments to act themselves.

  Under this general framework different types of platforms have emerged. One type focuses on bringing about major change in the national research landscape, coming up with radically new ideas, promoting innovative research policy concepts, etc. Another type of platform focuses on tangible progress on the basis of research achievements. A typical initiative of this type is the launch of 'lighthouse projects' to demonstrate the feasibility of innovative new technologies.

[37] Such boards can be of a purely advisory/consultative (for example scientific advisory boards), supervisory (approves strategies and important decisions) or Management board nature.

- *(Operative) joint decision making*

  In contrast to national research policies, regional or cluster research policies are typically defined and implemented jointly by Public and Private Sector. In such clusters, Public Sector research institutions, Private Sector R&D and other stakeholders work together very closely, including financing and execution of joint research, shared support infrastructure, etc. This mode of operation implies

  - co-financing and co-execution of research activities between involved Public and Private Sector actors; and
  - co-decision-making in strategic and operational questions.

  Obviously, this type of interaction has more the character of a peer-to-peer relation than the advisory role which the Private Sector has vis-à-vis policy makers in national research issues. Accordingly, this type of operative interaction also follows very different rules.

  However, there is also a close link to national research policy decision making, because the formation and development of such clusters can be stimulated by policy measures on a national level (see the BioRegio case study on page 20). This example demonstrates how research policy measures can stimulate the formation and development of research and innovation clusters.

- *Delegated implementation*

  Another form of Private Sector interaction is the delegation of operative tasks to Private Sector institutions. Private Sector enterprises can act in an agency-type role to execute research policy measures. In such cases, the Public Sector defines the policy measure and is responsible for its implementation. But the necessary tasks are delegated to a Private Sector 'service provider'

  A typical form of use of this approach is the management of an applied research fund by a Private financial enterprise on behalf of the government.

- *Operative support*

  The operational interface with Public Sector research is of high importance for Private Sector enterprises. Therefore they have a strong interest in the development of appropriate support measures, infrastructures, etc. This can include for example match-making to help SMEs find Public Sector research partners, technology centres and technology transfer arrangements and institutions or operative support like model contracts for collaborative research agreements.

  The Private Sector can also be involved in the instigation, design and operation of such operative support, for example through policy proposals, co-financing or co-management

- *Private Sector research funding*

  One of the most powerful yet often overlooked ways how the Private Sector exerts a significant influence on Public Sector research and related policies is funding of research. Private Sector companies do not only fund own R&D, but also finance research of Public Sector institutes. Thereby, they have an obvious potential influence on research strategies, project portfolios, etc. of such institutions.

  The traditional mechanism for this are research contracts, funding of dissertations, etc. These define exactly what type of research the institute is expected to undertake and which results are to be delivered. Experience with such limited forms of involvement shows its limitations. They work well in cases where a specific research topic is know and where a limited, precisely defined value added of Public Sector research is sought. But they are not suitable as a means to integrate the Private Sector partner in the broader creative environment and permanent stream of innovative ideas generated at research institutes. Therefore, new innovative approaches have emerged. Examples include

- *Private Sector funding of basic research without a firm prescription of research areas and results.*

  The idea behind this is that the Private Sector Partner's funding enables research in area of interest. In return, he benefits from the creativity of the scientists though a privileged sharing of the results.

- *Co-funding and operation of a platform for joint R&D in a target sector*

  As many companies have reduced their own research efforts while remaining dependent on scientific progress, a new form of collaboration research, joint research facilities, has emerged in sectors where Private Sector interests and national research policy objectives coincide. This can include shared or embedded laboratories, where Public Sector and Private Sector research staff work together at the same location. With a higher investment, the Public Sector can also operate a research facility in close coordination with the important Private Sector actors who at the same time are the main 'customers' of such a facility.

- *Charitable foundations*

  In some countries, not-for-profit organisations, which are often privately-funded, play an important role as sources of funds for research. In this role, they define their own research priorities, select independently the projects which they fund and thus can have an important impact on the whole science system and on research policy priorities. Notably, such foundations are not obliged to adhere to the criteria usually applied by policy makers in programme/project selection. And they are not subject to the economic pressure to create short-term economic return on research they fund. This gives them the unique opportunity to promote areas which are not among traditional research policies' or the Private Sector's priorities (e.g. orphan drugs).

  In addition, some foundations also engage in a role as 'think tanks' to drive change, financing research policy studies and forwarding own policy concepts.

3.3 Criteria for classification and selection of approaches and instruments

Our analysis has revealed a multitude of mechanisms and instruments for Private Sector involvement in Public Sector research policy decisions. To be of practical use for policy makers and Private Sector stakeholders, criteria are needed which help them to understand the benefits, limitations, characteristics and ranges of applicability of the available approaches to stimulate, support and manage Private Sector interaction.

The different types of instruments have to be seen as elements of the multifaceted process of research policy decision making. But depending on the specific circumstances, they may not all be equally important or realized in any particular instance. If a National Science and Innovation System, sector or community is already highly mobilized and relatively cohesive around a research policy issue, for example, making claims and engaging in the development of policy approaches may be the most important form of interaction.

For this purpose, we propose to consider the portfolio of possible approaches described in chapter 3.1 as a 'toolbox' from which the most appropriate instrument can be selected, depending on the specific situation and needs. To help classify these instruments and to choose the most appropriate one, the following questions may serve as guidance:

- *Who determines the policy domain for interaction, instigates and drives Private Sector involvement?*

  The impetus for involving the Private Sector in policy decision making and inputs can come from either side (see Figure 10). Depending on who takes the initiative, the parties have different instruments at their disposal. Norway's OFU and IFU policy measure (*Offentlige og industrielle forskning og utviklingskontrakter* - Public and Industrial Research

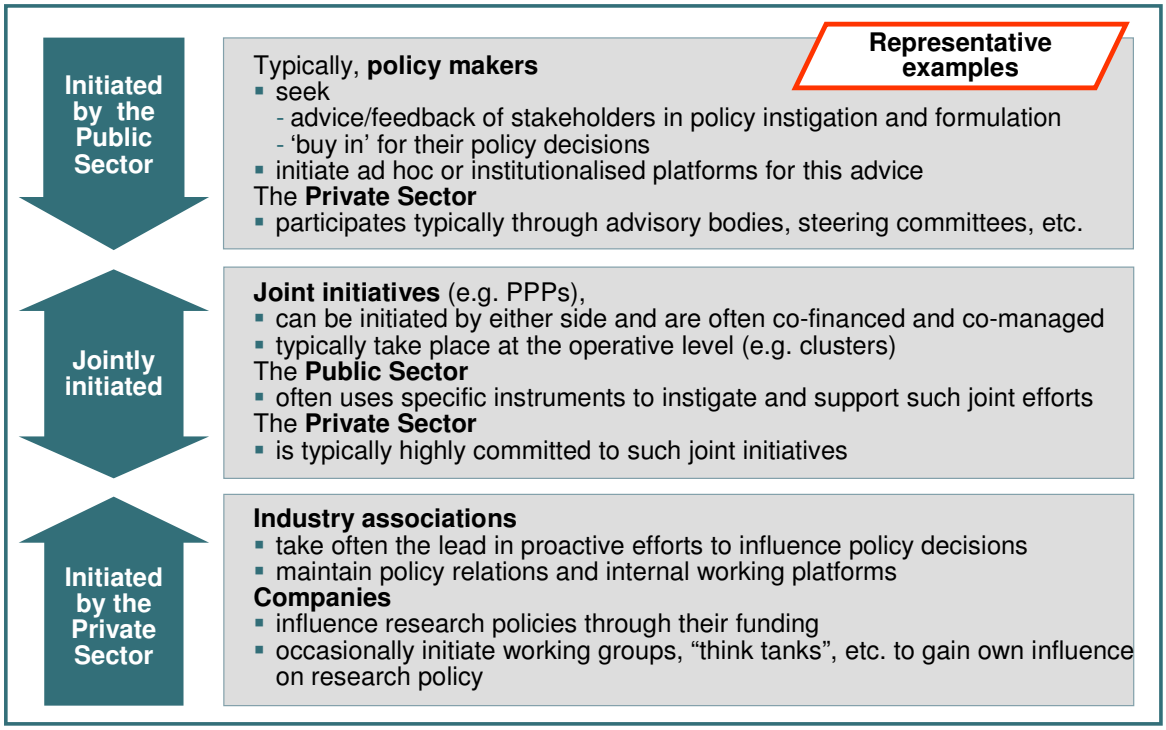

Figure 10: Generic options for the initiation of Private Sector involvement

and Development Contracts) stimulates collaborative research involving SMEs through a contractual framework where (in the case of OFU) the purchasing side is a public authority. On the other side of this spectrum, the example of COTEC Portugal, described on page 47 shows that a Private Sector-initiated and driven initiative can also stimulate enterprise-oriented collaborative research through completely different mechanisms.

- *What is the purpose of initiating the interaction?*

  We can differentiate roughly between eight types of involvement which pursue different objectives[38]

  (1) Interest mobilisation

  Gaining the Private Sector's commitment to interact in research policy making depends in a first step on the Public Sector's capability to ignite initial interest and to encourage potential candidates with a latent but not yet active concern to acquire information and to develop positions.

  (2) Claims making

  Given their own (commercial) objectives, Private Sector companies have a natural desire to express their existing needs and requirements, positions and values which concern Public Sector research. Such claims may be represented indirectly via advocacy organisations (e.g. industry associations) or they may be expressed by the company itself or one of its representatives as an individual participant in research policy decision processes.

  (3) Knowledge acquisition

  Private Sector knowledge may be an important research policy input, for example to gain a better understanding of the potential of new research areas or to assess the possible impact of a planned research policy. Such Private Sector expertise can be of an expert nature (obtained through analytical work) or of an experiential nature (based on personal or corporate experience).

[38] In line with similar approaches in other policy domains, see for example Phillips 2002

Case study COTEC Portugal: The Private Sector in the 'drivers' seat'

Prior to the launch of COTEC Portugal, the enterprise association for innovation, in April 2003, the Portuguese innovation system provided little incentive for Private Sector research and innovation. The Portuguese economy was dominated by the traditional low-tech sectors. Public Sector support for research was fragmented and concentrated on funding public research. Although the performance of public research institutions grew continuously, they had little impact on the level of competitiveness of the Portuguese economy. And motivation and efficient mechanisms to convert scientific knowledge into commercially usable innovation were limited. As a result, both sides showed little interest in intensifying their interaction.

However, among a limited group of corporate leaders growing awareness of the need to change this situation emerged, inspired by similar movements in Europe, e.g. in Spain and Italy. But a dedicated initiative became only possible when Portuguese thought leaders succeeded to match their initiative with the country's president, Mr. Sampaio's growing interest in innovation as driving force for national economic progress. As a result, the COTEC association was formally announced in April 2003. The president took the patronage of COTEC and has become since then an integrated essential driving force and an important catalyst for COTEC's growing visibility and impact on the Portuguese research and innovation system.

As an association of business entities, COTEC encompasses most of Portugal's largest companies and Private Sector R&D performers. On this basis, COTEC could attract other important players and has expanded since its conception to a current membership base of 106 associate members. Nevertheless, virtually all top 100 Portuguese firms representing approximately 20% of Portuguese GDP are COTEC members. This gives COTEC a certain mandate to speak as the 'voice' of the industry. Since June 2005 COTEC is also expanding in the SME area, waiving the fees for selected firms. There are currently 24 members of the innovative SME network, with more expected to be invited.

This group of companies has identified three major strategic themes for the association: (1) Promotion of a culture of innovation across the national economy; (2) fostering of the practice of innovation by all entities within the Portuguese innovation system; and (3) influencing the strategic orientation of the Portuguese Science and Innovation System, but also at a European level, with the objective to shape innovation policies in a more business-oriented way.

COTEC's strategic approach aims at bridging the gap between knowledge generation in science and its commercial application through projects with high visibility in areas where there is a high need of the Portuguese society for innovative solutions. Through this approach, COTEC achieves high leverage with relatively little additional funds, based on excellent project management and an extensive network of cooperating firms.

The backbones of COTEC's activities are initiatives to create and spread general awareness of research and innovation and to foster research-oriented interaction among Portuguese Private Sector companies and with their Public Sector counterparts. This includes initiatives like the COTEC annual meeting, the COTEC Innovation Award, Innovation Portal etc. A complementary second type of activities includes selected studies and projects on specific issues. These include research projects which yield advanced technologies and innovative solutions as well as technology opportunity studies and targeted initiatives like COHiTEC, the Minho Software Cluster or the definition of innovation indicators.

In the constitution and operation of COTEC, three key success factors turned out to be crucial: (1) Independence from Public Sector influence; (2) Participation of a critical mass of networked companies; and (3) efficiency in the operations of COTEC's internal operations and in its selection and execution of projects and initiatives.

(4) Spanning and bridging
There is a high potential benefit for both sides from participating in different networks. This permits policymakers, Private Sector representatives and other stakeholders (e.g. from Public Sector research) to tap into a broad range of knowledge, to better learn from each other and to instigate and cultivate relations and alliances.

(5) Convening and deliberating
A direct dialogue among equals between the parties involved in research policy making allows both sides to convey their views and proposals in a very efficient way and to form horizontal bonds of affiliation.

(6) Community capacity building
To enable collective action, to build a critical mass of know how, resources and political weight as basis for a sustainable impact on research policy, Private Sector actors should seek the development of communities of interest and practice or – if appropriate – their integration into such existing communities.

(7) Analysis and synthesis
The involvement of the Private Sector may add considerable expertise and creative potential to analysis, identification and evaluation of policy options, assessment of their impact and feasibility and other elements or research policy decision making for the benefit of both sides.

(8) Transparency and feedback
Clarity on how Private Sector input was used and whether it made a difference to actual research policy decisions is an important element of building trust and of reinforcing a constructive dialogue.

A strong fit between the desired type of impact and the approach chosen is instrumental. Any mismatch here can prevent the development of a constructive interaction, for example if a lobbying approach is chosen when knowledge acquisition is sought, if urgent messages and claims are conveyed via 'soft' channels, etc.

- *How do Private Sector messages reach their addressees?*

Individual professionals, companies, professional associations, think tanks and pressure groups can get access to research policy decision processes via different routes[39]:

(1) The legislative route
Parliamentary or Legislative Committees and Inquiries represent institutional targets for stakeholders seeking to be involved in research policy decision making. For example, invited written submissions or testimonies in hearings can give external stakeholders the opportunity to influence findings, conclusions and resulting policy formulation. However, such committees tend to favour 'expert' opinions, and their deliberations are usually subject to political party discipline. They may also take years to run their course or be significantly altered or abandoned after a change of government.

(2) Formal consultation
In many countries, more or less sophisticated formal consultation practices have evolved in recent years. The advantage of such formal consultations is that they build on a high attention of both sides (often further enhanced through high visibility of the outcomes). Success depends on the quality of the prepared statements and how convincing they are brought forward.

(3) Bureaucratic access
In many political systems, legislators act as the formal decision makers at the level of overall guidelines. But more detailed decisions are prepared and formulated by gov-

[39] The following scheme has been inspired by Stone 2001.

ernmental administrative bodies, in particular by the ministries responsible for research policy. Therefore, an alternative route for external stakeholders is to cultivate relationships with senior bureaucrats and advisors, either through informal interactions or within policy communities.

(4) Informal exchange

Very often, policy makers and Private Sector associations maintain continuous relationships, for example in the form of regular informal meetings where actual research policy and related issues are discussed. This type of low-profile, informal relation can serve for example as an early warning system to identify potential future priority issues and to exchange provisional views and positions before they become 'official'.

(5) Policy communities, networks and events

Policy networks are characterised by relatively stable (and often non-hierarchical) inter-relationships between actors with common interests. Therefore they are particularly suitable platforms for testing new ideas and for developing them in a non-binding type of dialogue[40]. Events like research policy platforms provide an even more 'neutral' ground, which is particularly suitable for creating awareness, bringing stakeholders and policy makers together, discussing status and options in research policy areas of interest and stimulating creative new ideas.

(6) Local participation and knowledge

Research clusters and other operative local initiatives have often developed very different participatory 'grass roots' governance styles. These have established their own set of interaction mechanisms, based on the existing direct intensive interaction of the Public and Private Sector actors and on their shared investment in and commitment to the research objectives of the cluster. Research policy makers from the national level usually do not intervene at this level. But they have specific instruments at their disposal to stimulate the formation of such clusters and to support their development.

(7) The climate of opinion

Another strategy to influence policy decision processes is to change the general climate of thinking about a research policy issue, and thereby the political context in which decisions are made (James 2000, p. 162 ff.). To influence general opinions in such a long-term and indirect way for affecting policy change, approaches appealing to policy makers, stakeholders and the public may include for example press statements, studies, the use of media, eye-catching press releases, etc.

- *What is the right intensity and duration of interaction?*

  Even though there is a general trend towards long-term relations between the Public and the Private Sector, certain issues may not require a permanent interaction or a profound, intensive relationship (see Figure 11). To find the right interaction mechanisms and the appropriate instruments to stimulate

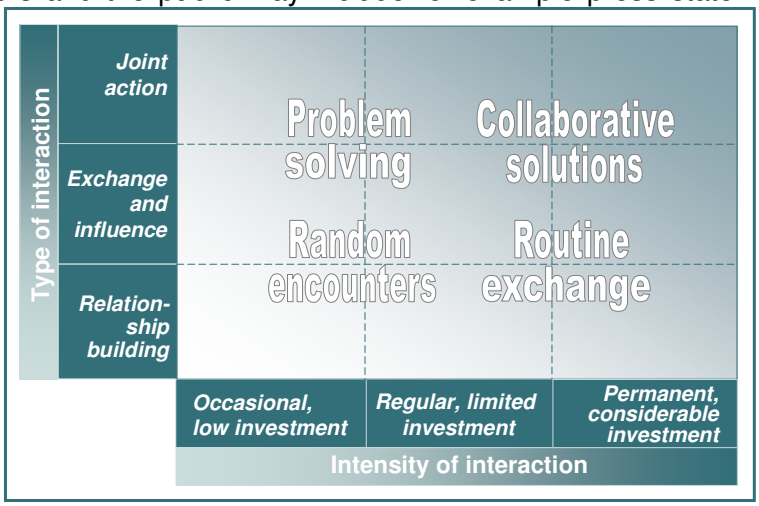

Figure 11: Intensity and type of interaction as a determinant for instrument selection

[40] Given the usually strong interpersonal nature of network relations and the high importance of mutual trust and a constructive dialogue therein, they are less suitable for formal statements, especially if they are of a confrontational nature.

them, it is essential to account for the expected and desired intensity and duration of interaction.

3.4 Formal and/or informal interaction

Formal interaction which operates in well defined structures and formalised mechanisms is the backbone of an efficient Private Sector interaction. But many of our interviews during this study have confirmed that this is only one of several important elements of an efficient interaction (see Figure 12).

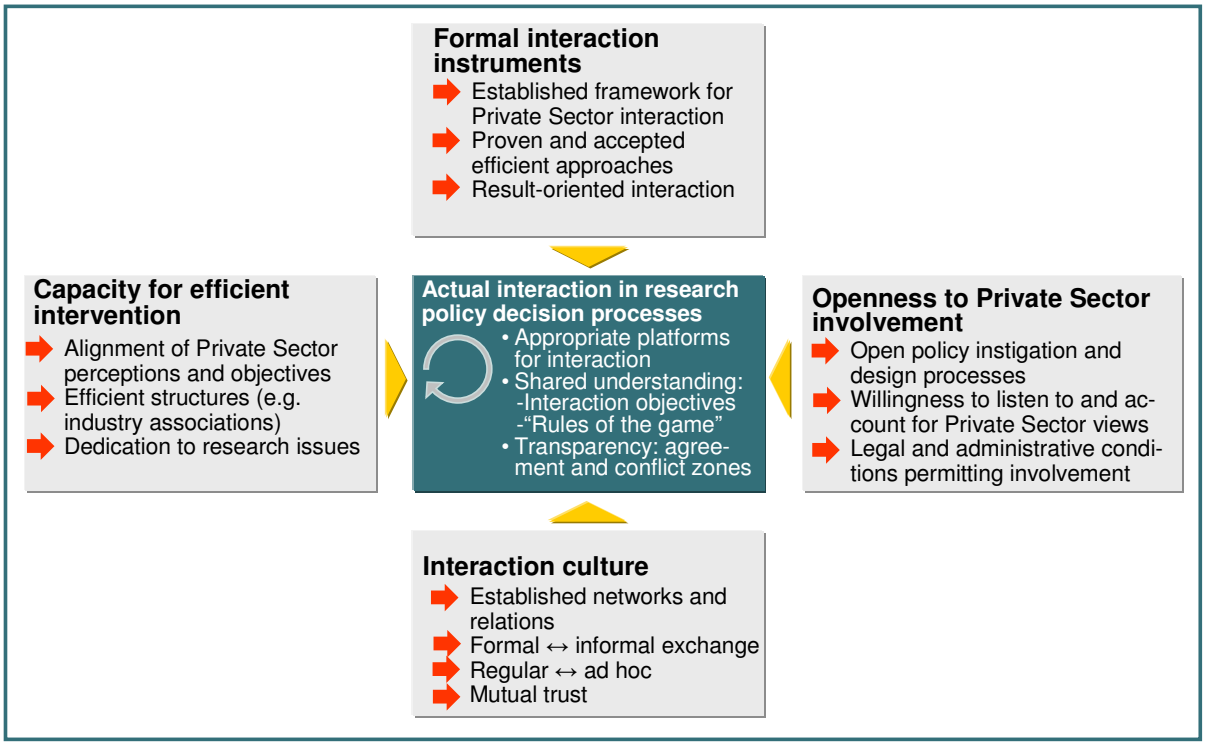

Figure 12: Determinants of the efficiency of Private Sector interaction

According to one of our interviewees "… the best formalised instruments will not work if the individuals involved do not interact personally…". Another interviewee commented "Formal meetings and decisions are important. But when we have a problem, we first call each other, get together informally and discuss it over a cup of coffee…". A third interviewee stated "The most valuable parts of research policy conferences are the breaks. Here you have the opportunity to meet other people, to establish contacts and to discuss things 'outside of the official protocol'…".

This suggests that there are two layers of interaction between the Public and the Private Sector in research policy making:

- On a *formal* level, the involved parties make 'official' statements in consultations and work out formal positions and agreements.
- On an *informal level*, the actors maintain their relationship and build mutual trust, have the opportunity to 'test' their positions and can work towards consensus (often before official formal negotiations take place).

Obviously, these two layers are not completely separated. Often, they overlap considerably and to some extent even stimulate or enable each other. For example, changes in the statutes and administrative regulations of Finnish research and higher education institutions have caused a multitude of (informal) interaction with Private Sector partners, based on the

mission to promote networking and research collaboration emphasised by these changes in the formal framework.

In addition, formal decision making builds also a lot on functioning informal relationships between the involved actors, for example through higher efficiency of discussions and alignment of views on the basis of an established 'discussion culture' and common language or easier consensus building in critical questions. On the other hand, a well-defined formal framework for interaction, which is accepted by all parties, can help in particular to convert verbal consensus into action, for example through the empowerment of committees[41].

Shared views on communication and conflict resolution can help to ease relationship and decision processes. In longstanding working relations 'rules of the game' evolve often over time. Some institutions have also formulated explicit policies for this purpose[42].

In 'point to point' interaction between Public and Private Sector individuals or organisations during the preparation and execution of research policy decisions, the informal relation layer plays an essential role. Typically, over time a 'discussion culture' evolves and both parties develop a common language to express and align their positions where necessary. This enables the Private Sector to convey his messages efficiently and the Public Sector to understand the Private Sector viewpoint and to incorporate it efficiently in its research-related decision processes. Such relations can also be interpreted as a joint mutual learning process, where the participants' knowledge adds to the knowledge of the other side and the creative tension between both sides stimulates the joint exploration of new ideas and concepts.

This 'point to point' communication is complemented by another important level of informal communication: Research and policy networks. On a formal level, such networks of interdependent actors connect public policies with their strategic and institutionalised context and the public, semi-public, and private actors participating in the research policy field. If policy-making is interpreted as negotiation over 'public action', the role of networks in responding to new ideas is largely a question of whether new ideas succeed in the official negotiation process or not. Thus, given the power relations involved in agenda-setting, networks can easily serve as platforms where 'winning' ideas evolve or where already dominant ideas are reproduced. This depends on the distribution of resources and decision power between the actors, the goals they pursue and their perceptions of their resource dependencies. Information, goals, concepts and resources are exchanged in frequent interactions, for which some formalisation and institutionalisation occurs over time[43].

Research policy networks provide also a shared conceptual language and help create common ideas and arguments that educate network participants into the values or consensus of the network. Networks with decision-makers as active participants have the potential to influence policy in both local and global domains. Even without such political involvement, the norms, values and aspirations of networks can have significant impact on the climate of elite opinion and culture of public debate.

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41 See for example the case study on the Dutch research policy advisory structures. These are based on a highly formalised structure with legally defined rights and obligations. However, their efficiency and success is based on the established discussion and working culture within the committees, between the committees and their administrative and corporate partners and – in a wider sense – on the consensus oriented policy culture in the Netherlands ('Polder model').

42 For example, a working group of the Max-Planck-Society addressed possible conflicts of interest between science and industry in its recommendations for *responsible behaviour in science* (see Max Planck 2001).

43 For details, see for example Kikkert 1997, Robinson 1999 or Struyk 2002. According to Struyk 2002, different types of networks can be classified using the following criteria: (1) objective (This can be for example efficient flow of knowledge among members, or specific spheres of influence); (2) incentives for and cost of participation; (3) basis for membership (Networks can be completely open, or restricted in various ways); (4) network coherence (Degree to which the network manages to build effective working relations and a sense of community amongst its members).

But networks have also a strong informal nature. They are not only means of 'public management', but rather an instrument to challenge public management through generating multiple unofficial and creative policy 'interpretations'. Over time these informal interpretations become institutionalised, but once they are recognised as official policy, the networks will already have started generating new unofficial ideas. This perspective emphasises the informal and non-linear aspect of negotiation processes over ideas, rather than the 'official' rational arguments (see for example Stacey 1995). Figure 13 depicts a generic evolution cycle for the participation of Public Sector or Private Sector actors in such research policy networks.

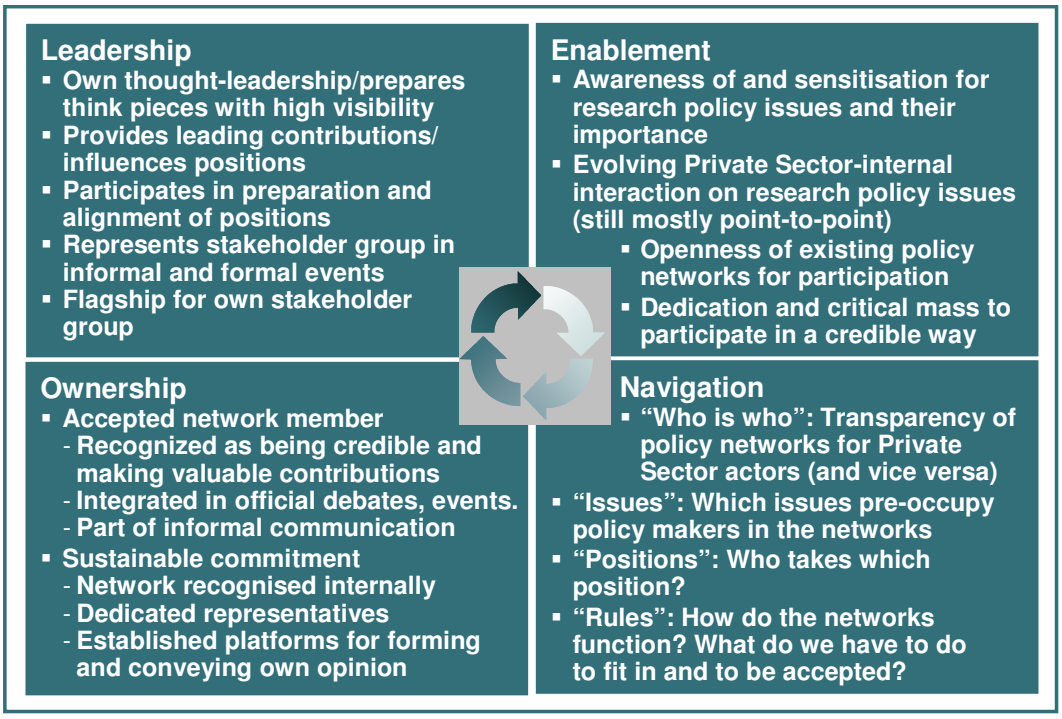

Figure 13: Evolution of network integration

In any case, there are strong reasons for Public and Private Sector actors to engage in research and research policy networks. However, the way how this takes place is determined by specific objectives and resources available for network participation, by the type and development stage of existing networks and by the overall policy and economic framework. This can create limitations for accessing networks and benefiting from them, for example in the case of SMEs: If the cost of network participation (not only financial cost, also management capacity and attention) is miniscule, access is easy and feasible for them. But if for example there are major costs of if they have to participate regularly in networking efforts without seeing an immediate benefit, there is no sufficient motivation to participate. But this attitude at individual enterprise level can become an important barrier for an efficient alignment and manifestation of the needs and opinions of such groups of enterprises and lock them out from network benefits, ranging from access to information to greater visibility and influence.

Through the use of specific instruments, policy makers can stimulate and support the formation and the development of research and research policy networks. This has gained importance especially on the level of regional research and innovation networks and clusters. For example, Israel's MAGNET programme stimulates the formation of R&D consortia with enterprise and academic participants in the pre-competitive phase.

Experience shows that formal incentives can stimulate research collaboration and cluster formation. But their success can not be enforced – this must draw on the right balance between a structured approach and a liberal environment which stimulates and supports the participants' own initiative, as described in the following case study of the Cambridge cluster.

Case study Cambridge: Liberal, stimulating environment vs. dedicated policies

The 'Cambridge Phenomenon' has often been quoted as a showcase example of a successful high technology business cluster that has emerged around a leading university. The number of high-tech companies in the region has grown indeed from about 20 in 1978 to an impressive number of approximately 1,500 high technology businesses either locally grown, or inwardly invested, employing in total around 44,000 people.

As sources of scientific excellence and of high-tech start-ups, the region's higher education and research institutions have played a key role in this process. The powerful combination of their rich pool of scientific competencies with a vast number of regionally active young, small, independent and indigenous companies in high technology sectors has attracted leading Private Sector innovators which have set up research units in and around Cambridge, or entered collaborations with high profile academic research groups. Today, these actors interact intensively in a unique set of networks which link them also to other important contributors, e.g. venture capital and consulting firms.

University representatives emphasized in our interviews that there is no central policy, using massive measures to stimulate spin-offs, partnerships or research contract acquisition, at the origin of this development. The University of Cambridge is a confederation of Colleges, Faculties and other institutions with a high degree of independence to define their own research priorities and attitude towards external partnerships. The University functions with a relatively small central administration and has traditionally limited its activities in this area consciously to the provision of services for business liaisons, commercialisation of research results, etc., and to agreed guidelines, e.g. on the allocation of income from such activities ("… We have a policy of having no policy…"). However, these activities have been intensified in recent years. For example, the capacities for commercialisation services, resources have been concentrated in one organisation, Cambridge Enterprise.

Academic staff has relative freedom to have links with industry and to share or retain intellectual property rights. In this climate, the initiative of both researchers and of their private Sector counterparts to interact has become a self-sustaining, auto-dynamic process with a rich spectrum of approaches to collaboration. These range from the traditional forms of contract research, licensing, etc. to modern approaches. For example, some colleges or faculties have made arrangements with leading technology firms where instead of traditional forms like contract research with precisely defined tasks, the Private Sector partner funds research without such restrictions that stifle creativity of research. In return, they get privileged access to share the results of this research.

Another crucial supporting factor is the existence of strong and loyal networks between university and external business community. For example, local venture capital firms perceive these networks as beneficial, because they give them privileged access to a unique pool of business ideas and potential founders. Therefore they are willing to invest in these networks and in the development of the regional community with own initiatives to build trust and visibility. This combination of 'technology push' and 'market pull' creates a unique, highly dynamic engine for the creation of business ideas and start-up companies.

This model may not be transferable to other university-centred clusters. It has grown organically over decades from an 800 year old university tradition and is based today on a local critical mass of researchers, students, businesses and supporting institutions, etc. This cluster has developed traditions and experience in collaboration, start-up foundations, etc. which can not be rebuilt in a Greenfield initiative. However, some of its key factors may serve as guidance for the development of other clusters with an intensive interaction of Private and Public Sector, notably (1) a world class academic research base as nucleus, (2) a diverse 'landscape' of other actors, providing demand, inspiration and support, including technology firms, venture capital, etc., (3) numerous links between academia and the business community in an 'intimate' and trustful atmosphere, and – last but not least – (4) a liberal atmosphere which encourages researchers' own initiative and provides recognition for successful founders beyond monetary incentives.

4. Status of Private Sector interaction in ERA and selected reference countries

4.1 Overview of findings from the country analysis

This study has identified the approaches used today to involve the Private Sector in research policy decision making. Today, in all European countries the importance of this interaction is recognised. Figure 14 confirms that a wide and growing array of approaches and instruments is used in ERA countries for this purpose. Important conditions for this interaction have been established and a basic set of approaches and instruments evolves.

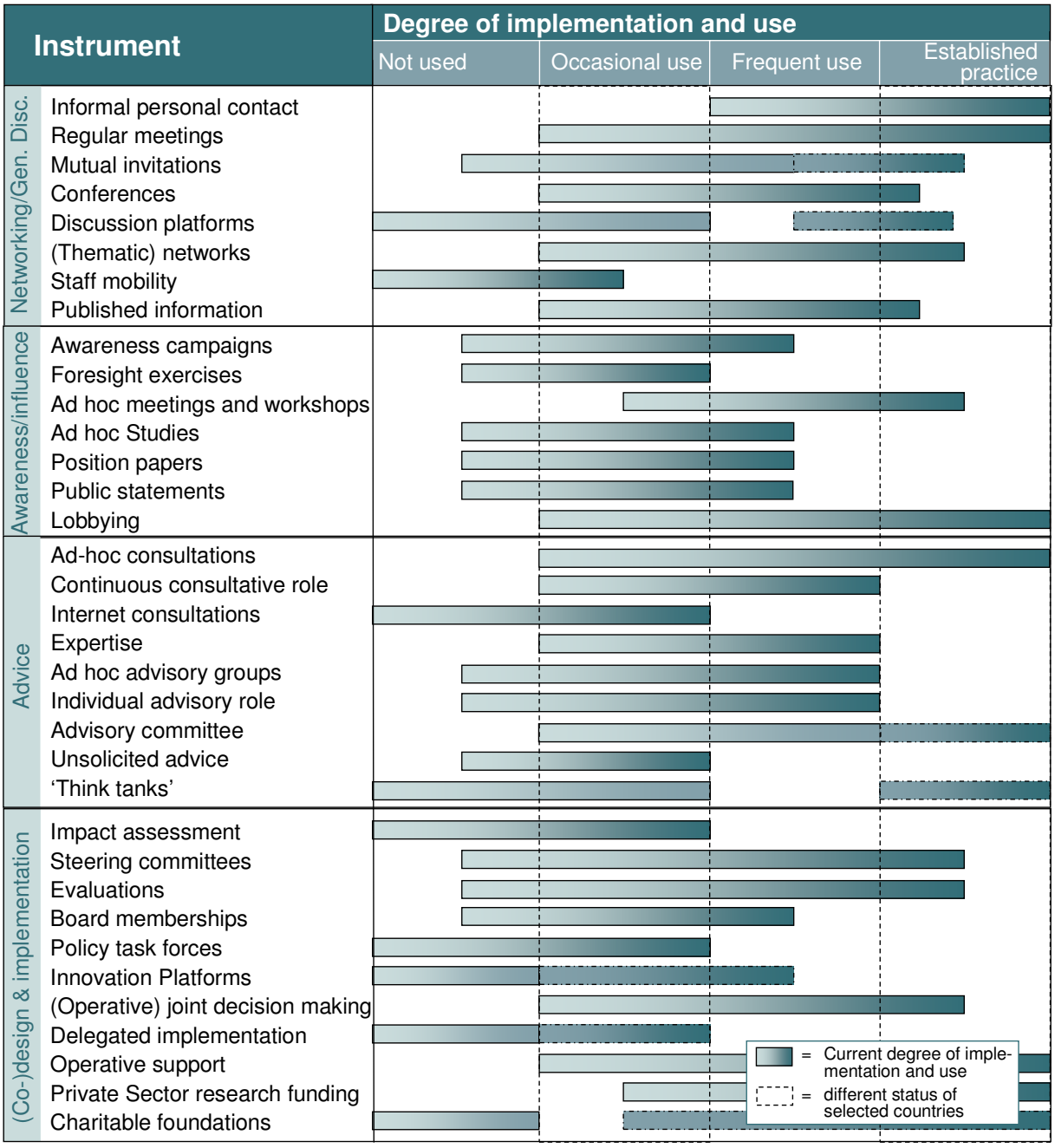

Figure 14: Degree of implementation and use of identified instruments in ERA countries

Table 3 provides further information on the application of instruments per country[44].

[44] For details, see the country profiles in the appendix.

Type of interaction		Old Member States															New Member States										Candidate C.					Other ERA					Other		
		Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	United Kingd.	Cyprus	Czech Repl.	Estonia	Hungary	Latvia	Lithuania	Malta	Poland	Slovak Repl.	Slovenia	Bulgaria	Croatia	Romania	Turkey	Macedonia	Iceland	Israel	Liechtenstein	Norway	Switzerland	United States	Japan	China
General discussion & networks	Informal contact/ consultations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Conferences	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
	Discussion plat-forms			✓	✓	✓		✓		✓		✓	✓	✓	✓			✓		✓	✓	✓	✓		✓		✓					✓		✓		✓	✓	✓	✓
	Networks	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
	Staff mobility and knowl. transfer			✓	✓		✓	✓				✓	✓	✓	✓			✓	✓	✓		✓		✓	✓				✓			✓	✓		✓	✓	✓	✓	
Awareness &influence	Ad hoc studies	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓			✓	✓		✓	✓		✓	✓	✓	✓	✓
	Position papers	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
	Ad hoc meetings and workshops	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Advice	Formal consulta-tions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Advisory groups & committees	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(Co-) design & decision making	Evaluation studies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	✓	
	(Steering) commit-tee participation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	
	Board member-ships	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓			✓		✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	
	Task forces		✓	✓	✓	✓			✓			✓	✓		✓	✓	✓	✓	✓		✓								✓				✓		✓		✓	✓	✓
	(Co-) funding of research	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	

Table 3: Comparison of current use of selected approaches and instruments for Private Sector interaction in research policy decision making

✓ = established instrument (Frequent or regular use)[45]
✓ = occasional or beginning use[45]

[45] Tick mark differentiation refers to the individual relative status of the application in each country.

4.2 Comparative analysis

To establish and maintain trustful and constructive relationships and to establish a continuous dialogue between policy makers and Private Sector actors, informal contacts/consultations and conferences are standard approaches. In addition, networks are gaining importance. With a focus on the creation of awareness and momentum, foresight studies and awareness campaigns are also applied in a growing number of countries. For the instigation and design of research policies, almost all countries extend these forms of general dialogue to an issue-oriented interaction as a part of their research policy decision processes. The approaches used most intensively for this purpose include ad-hoc consultations and studies, advisory bodies and formal consultations. Private Sector actors are also increasingly taking own initiatives, for example through position papers. In the implementation and assessment of research policies, the (co-)funding of research by the Private Sector is also standard in all countries where adequate Public Sector research capacities exist. And instruments like evaluation studies are gaining importance.

But even if almost all countries use the quoted instruments in some form, this should not lead to the conclusion that Private Sector interaction in research policy making is already sufficiently established and used in the most efficient way in all countries of the European Union. Approaches and instruments for this purpose are still applied and implemented in very different forms and to a very different degree in the countries of the Union, ranging from well-developed interaction systems where an intense and efficient interaction among fully committed stakeholders takes place to other countries which still work on establishing the basic elements of this interaction process in a consistent form and on getting the necessary commitment from all important actors.

As a first observation, the intensity and sophistication of the interaction processes vary considerably. For example in most Scandinavian countries, both sides have a long experience in this type of exchange and interact intensively and efficiently, supported by elaborate structures and processes. Some of the most advanced countries in this respect have also moved towards integrating individual interfaces to 'interaction systems'. The Netherlands' reformed advisory system is a good example for such a system[46]. But in many other countries, individual approaches to interaction in different policy domains or by different actors (e.g. ministries) still need to be enhanced and/or are yet not coordinated to the desirable extent.

A second important observation is that national approaches to Private Sector interaction are always country-specific. Depending on their individual needs, situations and relevant frameworks, different countries have developed different practices of interaction, which apply each a unique combination of interaction approaches, based on specific needs and on formal and informal 'rules of the game'. There is no such thing as a 'one fits all' solution', even among neighbour or economically comparable countries.

For example, in large, research intensive European countries like the UK, France and Germany, research and technology intensive sectors play an equally important role. Their economic and governance structures are complex and involve a multitude of actors, including strong Private Sector representatives which take an active stake in the research policy arena. But their different Science and Innovation Systems and economic structures, political/policy frameworks and research policy approaches have led to Private Sector interaction systems which are not comparable and which have completely different status and development priorities. In France, the interaction has been shaped by the country's central decision structures, its high public share of GERD and a concentration of Private Sector R&D expenditure on the largest companies. As France strives for rejuvenation its economic structures and for enhancing the importance of regions in research policy, a major joint effort is undertaken now to strengthen a more networked interaction landscape. By contrast, Germany's federal structure has fostered an almost opposite interaction culture, where a multitude of Public Sector

[46] See the case study summary on page 23

decision makers and Private Sector stakeholders interact in various individual forms and where overarching joint efforts need to be aligned on different levels. And neither France nor Germany have an equivalent for an institution like the Wellcome foundation, which plays a key role in the UK's research funding, thus exerting also a considerable influence on its research policy.

Another example is represented by smaller, research intensive economies with well developed research and innovation policies and governance systems, e.g. the Scandinavian countries, the Netherlands, Belgium or Switzerland. They have in common a high dedication to Private Sector involvement in research policy decision making and an advanced development status of the related interaction landscapes. Finland's Tekes has often been quoted as a good practice example of a transferable approach and used as a model for the development of comparable structures in other countries. But other types of national environments have stimulated different approaches which seem to work well in their specific environment. For example, the Swiss 'militia' system (in which a large number of individuals devote on a voluntary basis considerable time to civil society-related tasks like the participation in advisory committees, management boards, etc.) is an important enabler for the intensive mutual involvement of Public and Private Sector actors in their research policy-related activities. But this is based on the particular sense of corporate citizenship which is part of the Swiss culture and can hardly be transferred 1:1 to countries without such a tradition. In the same sense, the decentralised Belgian research policy governance system which permits different types of interaction 'subcultures' in such a small country can only be understood if the country's unique overall political structure and history is taken into account. It is difficult to imagine that such a system can be transferred to another country on a 1:1 basis.

A third example is represented by the new member and candidate countries from Central and Eastern Europe. They share common challenges, stemming from their transition from former central control to market economies. But their different economic structures and pathways to change have led to different evolving new structures, governance frameworks and resulting Private interaction landscapes. As a result, some common issues persist or have newly evolved, e.g. the high impact of foreign research investment in many of them (see page 64). But their different development pathways have lead to a wide spread of current status, issues and priorities in Private Sector interaction: Some countries of this group still strive to develop a critical mass of Public and Private Sector research investment and to establish a consistent first generation research policy and governance framework with adequate Private Sector involvement. By contrast, the more advanced countries of this group, e.g. Hungary, have already successfully implemented such a first generation of new research policies and interaction mechanisms. Their current challenges are now partially more comparable to those faced by other ERA countries in a similar situation, trying to strengthen their research systems and the role of technology intensive sectors in their economies.

When comparing country-specific approaches and instruments for Private Sector interaction and discussing their transferability, the wide spectrum of different forms and applications which each of them can take in 'real life' situations must be considered. The use of foresight studies provides a good example for this (see Figure 15). All foresight studies undertaken recently go far beyond the traditional 'study' approach which collects inputs from experts, but leaves the conclusions and resulting actions to the recipients. But recent foresight studies have been used to achieve a variety of different goals and applied considerably different methodological concepts and working procedures. Malta for example has used foresight to help raise awareness and interest of (potential) actors in and users of research and to provide a stimulus for the development of a critical mass through pragmatic exercises involving the actors directly in the development of a basic line of thought. In a different approach, Sweden has used a technology foresight study, jointly conducted by the Public and the Private Sector, to identify innovation areas with potential for growth and renewal to guide public research investment and Private Sector R&D and innovation efforts. A third possible approach was chosen by France in the Futuris initiative, where the objective was to launch a

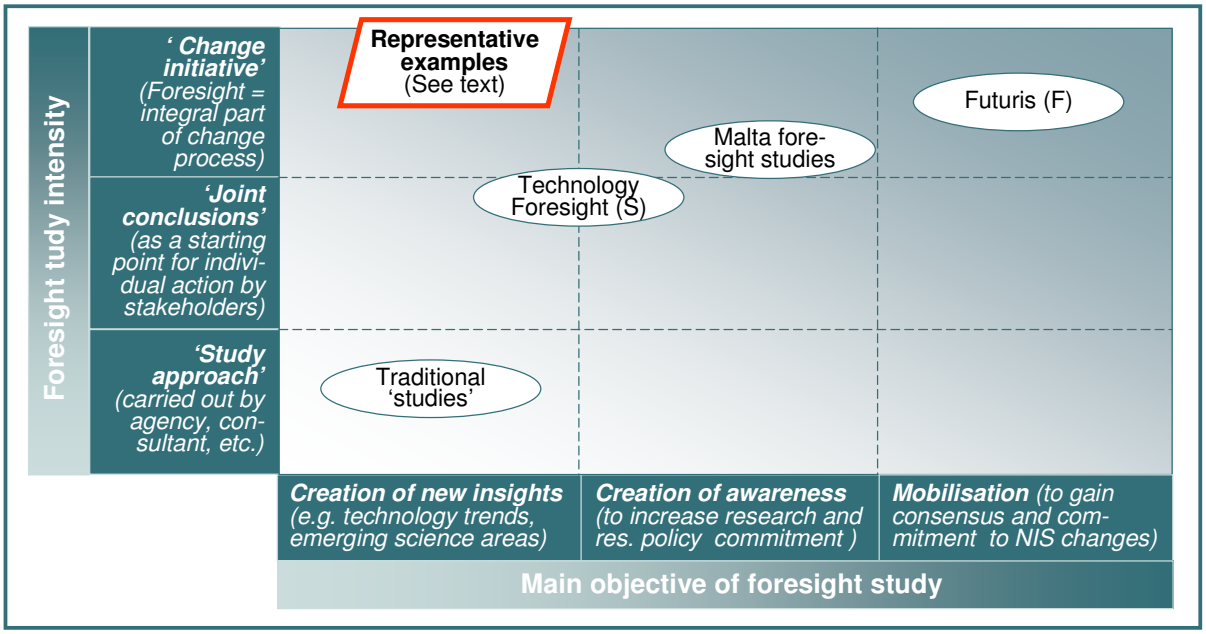

Figure 15: Different types of foresight studies, depending on their objectives and approach

rethink and reform of the existing Science and Innovation System, to solicit ideas, concepts, feedback and to obtain acceptance from all stakeholders for a necessary re-orientation.

The case study of COTEC Portugal on page 47 provides another example for a highly country-specific application of a general approach. Even if its foundation was inspired by the example of similar initiatives, especially in Spain and Italy, COTEC Portugal was designed differently to account for the specific situation and challenges of the Portuguese economy and its Private Sector and other stakeholders.

National interaction approaches and instruments are shaped by their respective different framework conditions, the needs of Public and Private Sector actors and by other influencing factors. The resulting interaction systems are not the results of a rational planning and design. They have grown historically and contain also a large cultural element. The individual general policy and enterprise environment and the 'unwritten rules' of communication and behaviour in a policy making environment lead to highly specific national interaction landscapes.

Therefore, the transfer of successful approaches and instruments for Private Sector involvement to other countries should focus on those which (1) fit to their specific systems, needs and development stages, (2) are compatible with the national interaction culture, (3) are acceptable and feasible for the involved actors and (4) add specific value to their governance and interaction capabilities. Often, this implies that economic and governance structures, policy frameworks, etc. are similar. But in other cases, comparable framework conditions may not be a sufficient prerequisite for successful transfer. According to our observations, a fit between the development stages of national systems and interaction concepts is the most important success factor. For example, the introduction of highly sophisticated advisory structures may not achieve the desired leverage if the necessary prerequisites (e.g. a high level of awareness and commitment, political affinity, timing, efficient policy decision processes, critical mass on the Private Sector side, etc.) are not in place.

With respect to this criterion, we propose to differentiate between three generic archetypes of research policy and governance frameworks for Private Sector interaction[47]:

[47] It should be noted that these are archetypes. Very often, countries can exhibit characteristics of different archetypes in different elements of their research governance framework and related Private Sector interaction.

- *'Forerunners'*

  Research-intensive countries with advanced Science and Innovation System government structures (especially some of the large European economies as well as some smaller, but highly research intensive, high-technology-oriented economies) tend to be also those where the Private Sector interface is most advanced. Typically, they have already sophisticated, well-established mechanisms for Private Sector involvement in place which are recognised and intensively used by the stakeholders. Such experienced 'forerunners' learn in particular from their peers about innovative, new approaches to maximise the leverage from Private Sector interaction for both sides. At the same time, they are important sources for the transfer of proven concepts and of experiences with their implementation for the 'followers' and 'beginners' groups.

- *'Followers'*

  Countries with a medium technology and research intensity, including the most dynamic of the new member countries, have usually established already a basic awareness of and commitment to Private Sector involvement on both sides. And their first generation of interaction processes and mechanisms are in place. But to fully exploit their potential of this interaction, they need to further broaden and refine their Private Sector involvement, including the introduction of proven advanced concepts like sophisticated advisory and consultation approaches, cluster-oriented initiatives, etc.

- *'Beginners'*

  Countries which still need to accelerate the transition from traditional structures to a knowledge-based economy with a higher share of research and technology intensive sectors still face the challenge of fully establishing their first generation structures and processes for an efficient Private Sector interaction as part of a broader effort to build up modern research governance structures. Countries where technology and research intensive sectors did nor play an important role in the past, including some of the new member countries, should therefore focus on creating awareness, gaining support and commitment for the development of this interaction, building a sustainable base of permanent contacts and interaction and establishing appropriate instruments for this purpose.

This leads to a learning path where each of these groups can benefit from the experiences of the more advanced group if an efficient transfer takes place. But in the course of this cycle, the types of new insights and the roles of actors can change. Yesterday's 'learning' actors can become tomorrow's sources of insights for others. In addition, this typology is not a 'must: We have also found examples where 'beginners' or early 'followers' came up with innovative new approaches[48].

A complementary learning and transfer process can and should also take place on the Private Sector side. For example, European or other international associations can play an important role by transferring successful approaches to their national member associations[49].

But such an output-oriented classification is by far too general for policy makers to help them determine which type of interaction environment their specific National Science and Innovation System represents, which development directions should be applied and which approaches and instruments they should favour in their further efforts to improve the interaction. Therefore the following chapter develops some further criteria for decisions on the selection and application of instruments for Private Sector interaction on research policy decision making.

[48] For example, the absence of historically grown governance frameworks and relationships can be favourable for grassroots development of innovative policy solutions in CEE new member states because there are no established 'claims' to overcome.

[49] See the CEFIC example on page 25.

4.3 Interpretation of country analysis results and possible classifications

To identify countries with similar or comparable patterns of Private Sector interaction, the major criteria are their Science and Innovation System characteristics and relevant framework conditions. These include the national economy's characteristics and the governance 'landscape' in which Private Sector interaction in research policy decision making takes place. Both are very heterogeneous across Europe. To identify clusters of countries with such similarities, we found the following criteria and typologies:

(1) Size and overall research expenditure

The size and research intensity of European economies vary by more than two orders of magnitude (see Figure 16).

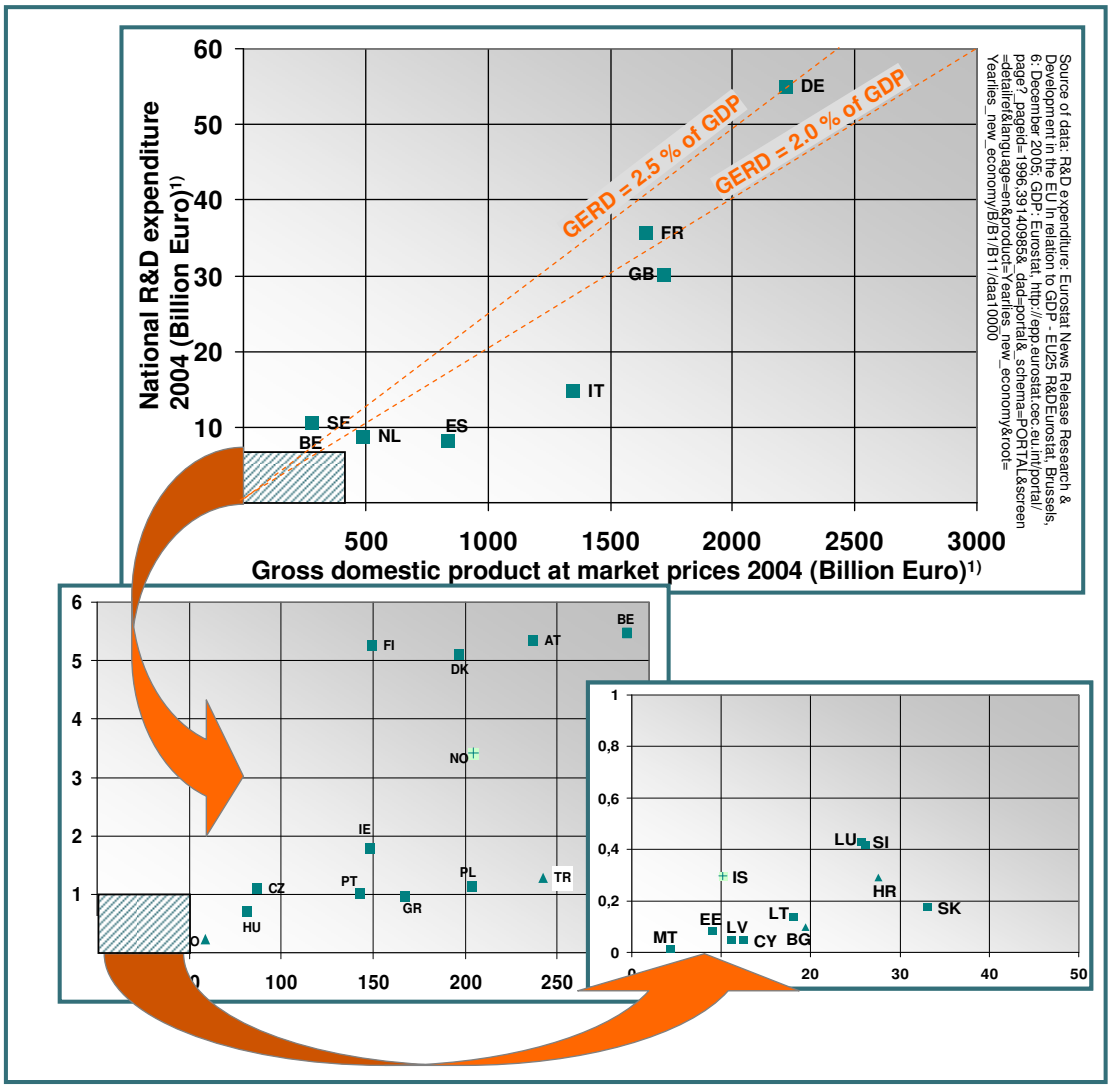

Figure 16: Overview of European economies' research intensity relative to their size

These differences have obvious implications for Private Sector interaction. Obviously, larger economies have less problems of assembling a critical mass of Private Sector research performers to be involved, while smaller countries enjoy the benefit of shorter distances and less complex communication due to the limited number of actors involved. Beyond this, we identified the following patterns:

- Highly developed, technology intensive economies with well-established Science and Innovation Systems tend to be forerunners in intense, efficient Private Sector interaction. Their governance structures have recognised interfaces for Private Sector inter-

action in place (e.g. advisory structures, consultation mechanisms, etc.) and they develop these further, driven by a consensus of the value of such efforts.

- The advantage of medium to smaller sized economies with higher research intensity and a high dedication of policy makers to research seems to be the lower complexity of their research governance systems. The lower number of stakeholders and actors involved and shorter communication distances create a favourable environment for pragmatic, direct interaction, informal exchange on critical issues and consensus finding with a high degree of common sense.
- The major challenges of smaller economies with lower research intensity seem to be the development of a critical mass at the interaction interface, the establishment of an interaction culture and a highly visible ignition of a dynamic development of an interactive research policy development.

However, the size of European economies alone does not explain their capability to involve the Private Sector and the nature of their chosen approaches. Other characteristics have to be considered also. These are discussed in the following paragraphs.

(2) R&D intensity and innovation performance

Figure 17 depicts the distribution if research intensity and of the share of R&D investment financed by the Private Sector in Europe and in other comparable economies.

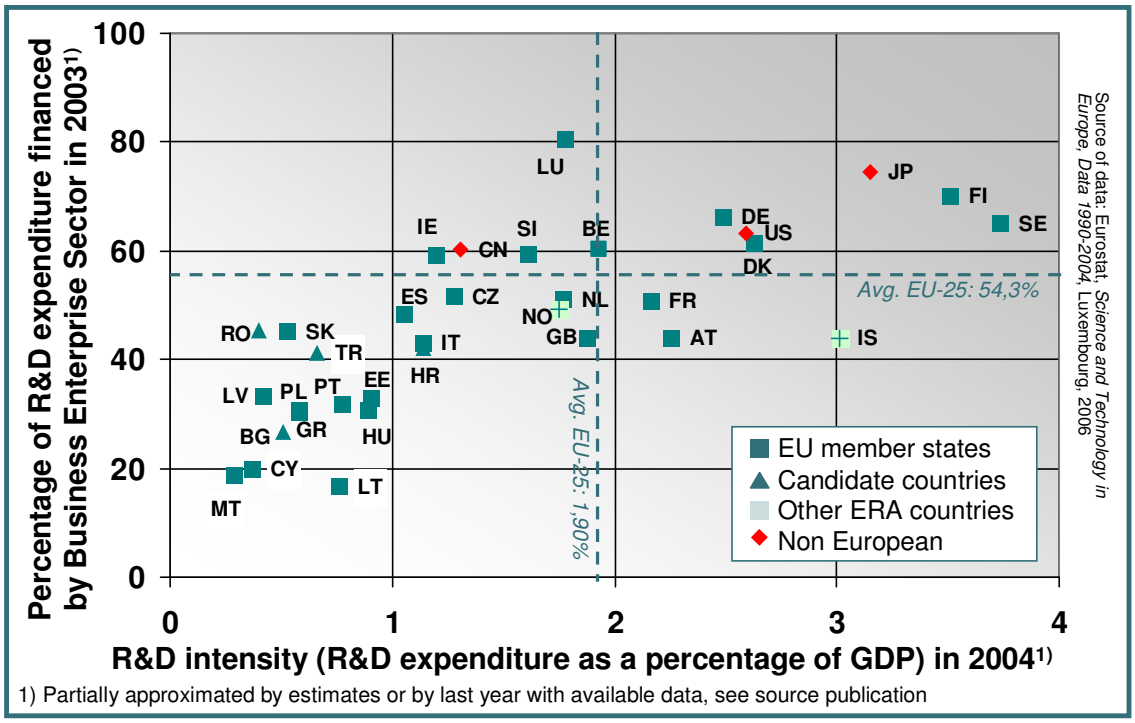

Figure 17: R&D intensity and Private Sector share of R&D funding

In general, countries with a high research intensity of which also a large portion is financed by the Private Sector (situated towards the upper right corner of the graph) showed also intensive interaction between the Private and the Public Sector in research and related policy issues. This seems to support the hypothesis that technology and research intensive economies are also those with the best developed Private Sector interface.

However, if this view is extended to the dynamic evolution of national research and innovation capabilities, additional aspects emerge. Figure 18 shows the results of the 2005 Innovation Scoreboard. At a first glance, the leading R&D spenders are also the core of the 'leading countries' group with a high innovation performance. But it is remarkable that they are not the most dynamic ones. Both the 'average' and 'lower' performers show an

exceptional spread of dynamics. The countries of this group on the right side of the graph are not necessarily among those with the most sophisticated research and innovation governance systems, but are catching up rapidly (even if partially from a low base). But all of them have made this a priority and are dedicated to develop appropriate systems and to understanding and appreciating the Private Sector's view carefully in the development of research and innovation policies. It could be inferred that the absolute degree of sophistication of a National Science and Innovation System and of its governance structures is at least not the only decisive factor for its research and innovation dynamics.

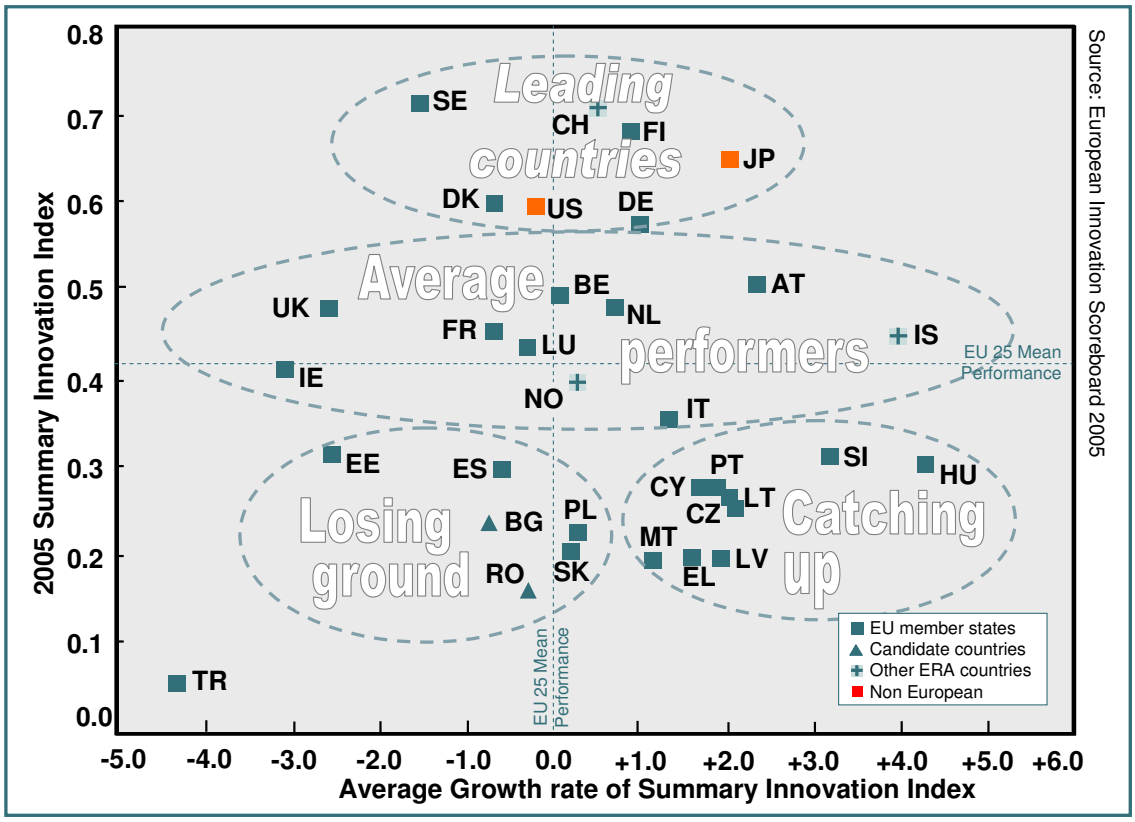

Figure 18: Wide spread of innovation dynamics among ERA countries[50]

This picture has two implications for Private Sector interaction in research policy decision making. The vertical axis of Figure 18 correlates to some extent with the classification used earlier in 'forerunners', 'followers' and 'beginners'. And its horizontal axis may provide an indication for the necessary sense of urgency: The more a country loses momentum, the more it might have to reconsider and to revitalise its research policy priorities in an intensive dialogue with the Private Sector.

(3) Research and innovation governance

The spectrum of underlying national Public Sector research governance structures ranges from highly central to highly de-central[51]. But our findings suggest that an efficient Private Sector interaction is not tied to a specific type of National Science and Innovation System or governance structure. We could not find a significant relationship between specific types of governance structures and our (qualitative) findings on the efficiency or effectiveness of research policies' interfaces with the Private Sector. And an analysis of available literature does also not reveal a significant relationship between both factors.

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50 Source: EC 2005b Relative national innovation performance measured as a composite indicator (Summary Innovation Index) based on up to 26 indicators in 5 categories. For details see http://trendchart.cordis.lu/scoreboards/scoreboard2005/index.cfm

51 See page 27.

However, irrespective of the centralised or decentralised nature of a specific system, an efficient research governance system which favours and supports Private Sector involvement is an important success factor. This conclusion from our study is supported for example by findings of the EXIS report (EC 2005h) which uses four different indicators to measure the appropriateness of regulatory and government policies to encourage innovation. These include an index for appropriate innovation policies. Both indicators confirm that countries with a strong dedication to research and innovation policy and to interacting with the Private Sector perform well on these criteria. But again, there is no significant, visible tie to a specific form of governance or interaction visible.

Yet another result of this study is remarkable. According to both the EXIS set of criteria and the criteria of the European Innovation Scoreboard (see EC 2005b), innovation performance is strongly correlated with the innovation governance score of EXIS and other criteria which capture background conditions for the innovative activities of firms. The authors of the EXIS report conclude preliminarily that these results "*… suggest that innovation policy should consider background socio-economic conditions that favour innovation. One possibility is that good governance plays a key role in national innovative capabilities, possibly through creating favourable conditions for long-term investment…*"

(4) Economic structures and importance of innovative sectors

Examples like biotechnology and ICT show that innovative, technology-intensive sectors tend to combine attractive economic growth perspectives with a high R&D investment. At the same time, in such economic sectors, the Private Sector is also particularly interested in close relations and in collaboration with Public Sector research institutions and policy makers. Therefore technology-intensive sectors are often the most fertile grounds for the development of research policy-related interaction between the Public and the Private Sector.

Countries with a high share of the overall value added by their Private Sector in such technology-intensive sectors and with a high dedication to supporting this trend through appropriate policies should also be in a favourable position to develop an efficient interaction between policy makers and their 'customers' in the Private Sector[52].

The example of the information and communications technology (ICT) sector confirms this hypothesis[53]. With a share of 16.4%, Finland had the largest ICT-producing sector relative to business sector value added in Europe, followed by Ireland (13.1%). Both are at the same time examples of countries which have identified research and innovation policies in support of this devel-

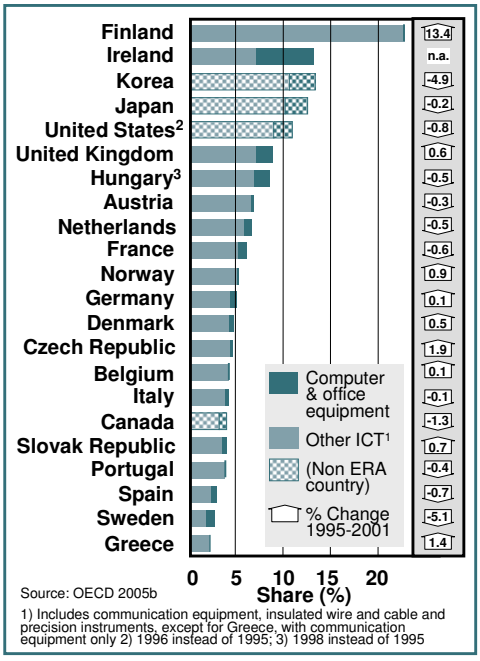

Figure 19: Share of ICT manufacturing in total manufacturing valued added 2001

[52] According to OECD 2005b, high-technology industries account for 48% of total manufacturing R&D in the in the European Union, compared with over 60% in the United States and 46% Japan. High-technology industries dominate manufacturing R&D expenditure in Ireland and Finland, while medium-high-technology industries account for 50% or more in the Czech Republic and Germany. Norway is the only OECD country in which medium- and low-technology industries account for more than 40% of manufacturing R&D.

[53] The ICT sector grew strongly in OECD economies over the 1990s. In 2001, the ICT sector represented 9.6% of business sector value added in the OECD area, and 8.6% in the European Union where its share varied between 16.4% and 5.4% (see Figure 19). Rapid growth was especially apparent in Finland, where the share of the ICT sector rose from 8.4% in 1995 to 16.4% in 2001.

opment as a national priority, promoted favourable framework conditions and developed their research and innovation policy governance system and related Private Sector interaction accordingly.

The Finnish example shows also how such a strong dedication of both Public Sector and Private Sector in the research intensive ICT growth business sector can have a major impact on national R&D spending (see Figure 20). Finland was obviously considerer by its relevant Private Sector R&D performers in this sector as 'the place to invest in R&D'.

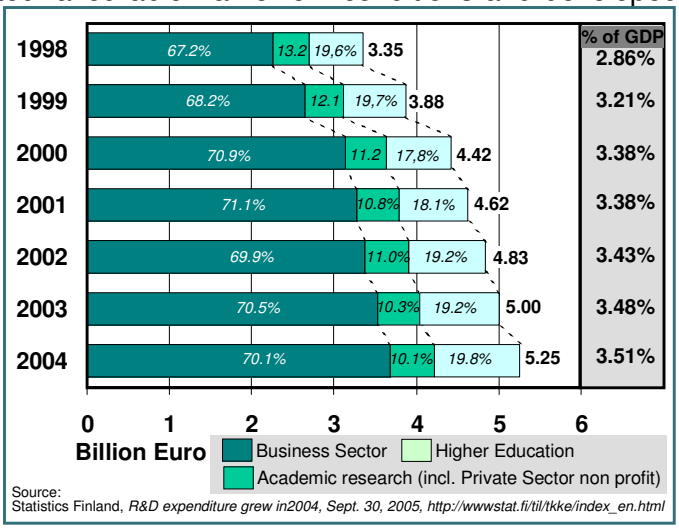

Figure 20: Finnish R&D expenditure by sector 1998-2004

(5) Foreign research investment

In the course of the globalisation of R&D activities, foreign investment in research and development is also growing in the countries of the European Union. As Figure 21 shows, Latvia had with over 35% the highest percentage of R&D financing from abroad, followed by Austria, Greece and in the United Kingdom, where it reached proportions of over 20% as well. At the level of the EU-25, the share of foreign funding of total R&D expenditure (GERD) reached 8.2% and 10.1% for expenditure on R&D in the Private Sector. For many EU-25 member states, the share of financing from abroad was less than 10%[54].

Latvia, Austria and the United Kingdom were also those countries with the highest R&D expenditure in the Business Enterprise sector financed from abroad with 44.5%, 30.1% and 27.2% respectively (in addition, Hungary's share is also remarkable with 22.6%).To a lesser degree, this applies also to the EU-25 total (10.1% versus 8.2% for the total) and the EU-15 total (10.2% versus 8.3%). In 14 out of 25 EU Member States, the share of financing from abroad is less than 10% both in total R&D expenditure (GERD) and in R&D expenditure in

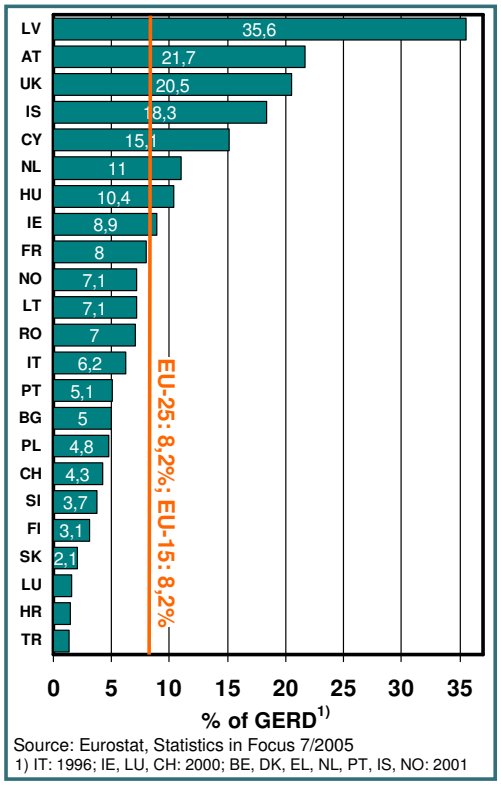

Figure 21:Percentage of total R&D expenditure (GERD) financed from abroad, 2002

54 This is especially true for some larger Member States such as Spain, Germany and Italy. For smaller Member States, the share of foreign funding in BES was generally higher for small enterprises. Furthermore, for those countries where the proportion is generally low, there seems to be a preference for the allocation of funds from abroad to smaller enterprises (This issue is taken up by the point 'Importance of specific actor groups / SME involvement' on page 66 (Source of data quoted in this paragraph: Eurostat 2005).

the Business Enterprise sector, including large member states such as Germany, Spain and Italy.

A large share of foreign R&D investment has important implications for research policies, for their decision processes and for their interface with the Private Sector. In such cases, an appropriate interaction with important foreign R&D investors must be sought to ensure their sustained commitment to national R&D investment, accounting for their specific needs. However, this can create a challenge, because research policy-related activities of such foreign companies tend to be concentrated close to their headquarters and governed from there, especially in large multinational corporations.

If foreign investors become an important or even dominant force in specific sectors of national industry and research, this can cause dependencies on foreign influences which limit the decision space for national research policy makers. The example of the manufacturing sector illustrates this (see Figure 22). In countries like Ireland and Hungary, the share of foreign affiliates in manufacturing R&D expenditure reaches over 70%. At the same time, the turnover share of these foreign subsidiaries also reaches its highest values in these countries with approximately 80% and 70%, respectively.

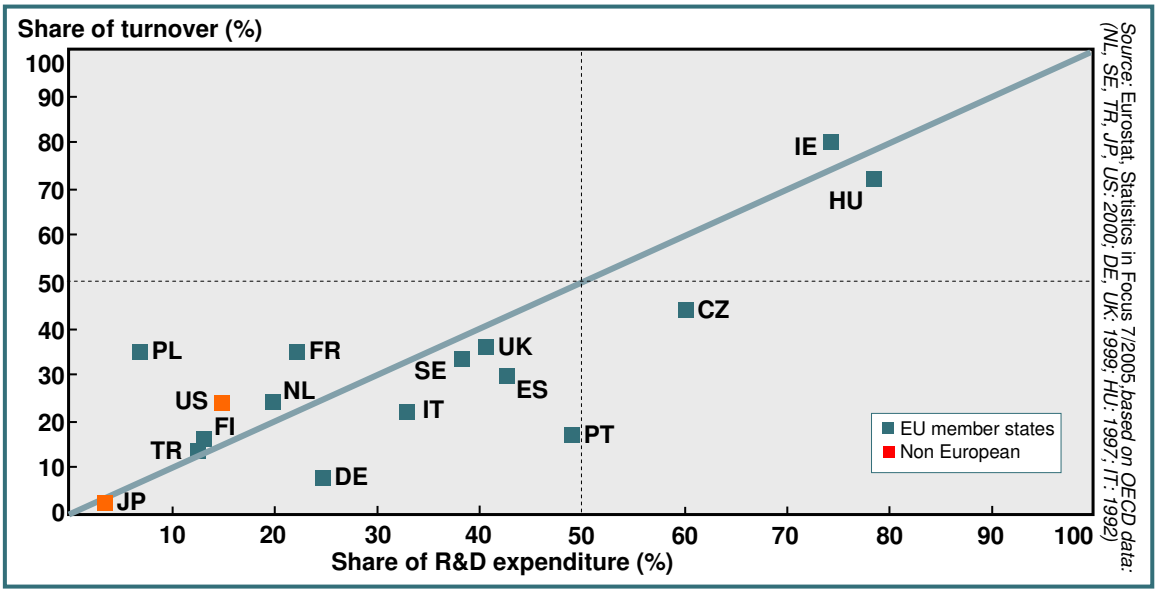

Figure 22: Share of foreign affiliates in manufacturing R&D expenditure and turnover in 2001 (in %)

This creates a high need for such countries to create durable links with foreign R&D investors to secure their sustained long-term RD investment and to stimulate them to invest in research with a high value added. This requires a high attention and responsiveness for their specific needs and a conscious effort to involve them in national research policy instigation, definition and implementation.

On the other hand, in countries where foreign companies are less engaged than domestic enterprises in Private Sector R&D in relation to their turnover (towards the upper left quadrant of Figure 22, for example e.g. Poland or France), their overall interest in research policy will be more oriented towards their home countries or other countries where they have important R&D investments. If in addition the remaining national Private Sector actors are a minority among the R&D investors, this has important implications for research policy. In such cases, the attraction of further foreign R&D investment can compete with the development of a national home base as a priority of research policy. This requires a carefully balanced interaction with both national and foreign Private Sector R&D investors to reflect their different needs and priorities in a consistent national research policy.

(6) Importance of specific actor groups / SME involvement

Only approximately 7% of all European SMEs co-operated with other firms or public bodies in the context of their innovation activities in the period 1998-2000[55]. But remarkably, this figure was much higher in the Nordic countries, ranging from 12% in Iceland to 20% in Finland. Co-operation was much less frequent in certain Eastern and Southern European countries[56]. Taking this innovation behaviour also as an indicator for the research area, this trend suggests that countries with a relatively low share of SME collaboration should undertake a special effort to raise the awareness of SMEs, to enhance their research collaborations and to involve them more actively in research policy issues.

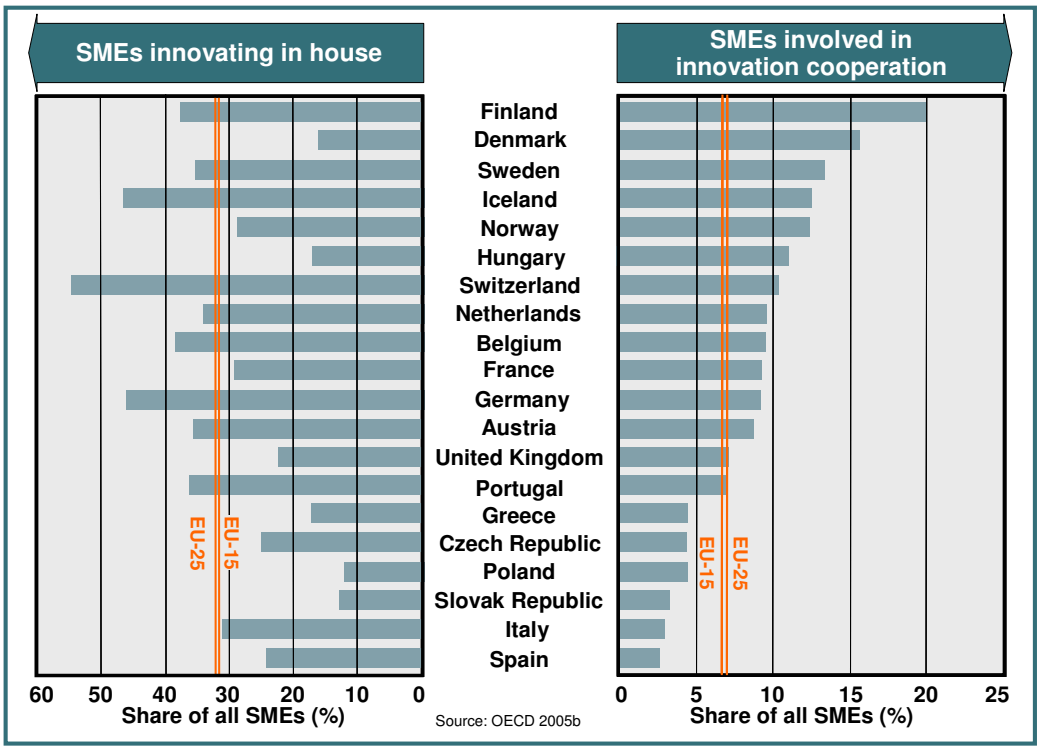

Figure 23: Innovation behaviour of SMEs, 1998-2000

The distribution of foreign R&D investment raises a similar issue. Taking a look at the relation between R&D spending financed from abroad and the size of the enterprises, several groups with similar pattern occur. Hungary (49.0%), France (29.8%) and Cyprus (29.7%) have the biggest share of foreign R&D investment coming from larger enterprises. In another group of countries, notably smaller economies, those with an emerging Science and Innovation System and those with a relatively low overall share of foreign R&D funding seem to favour investments from smaller foreign companies. This is the case for the Czech Republic (8.0%+7,2% for mid-sized companies), Estonia (53.6%), Portugal (31.1%), Romania (25.5%), Bulgaria and the Slovak Republic (7.8%). The opposite trend seems to apply to larger countries, especially those with an established, mature National Science and Innovation System (e.g. France, Germany, Finland and to some extent also Hungary[57]). Furthermore, when the relative share of foreign funding in

55 Source: OECD 2005b

56 For comparison: At the same period on average, around one-third of SMEs in Europe developed some innovations in-house (including in collaboration with other firms) and did not simply incorporate innovations developed elsewhere. The in-house share is much higher in Switzerland, Iceland, Luxembourg and Belgium, as well as in Germany. But it is below 20% in the Slovak Republic, Poland, Denmark and Greece (OECD 2005b).

57 For detailed country data, see the source of data in this paragraph, Eurostat 2005. The case of Russia, where foreign R&D investment is also dominated by larger enterprises, confirms this trend.

the total is rather small, the ratio seems generally higher for small companies. This is the case for Portugal, Slovakia, Bulgaria and Finland.

As a consequence, policy makers should also consider adapting their approach to Private Sector involvement to the types of foreign R&D investors which are the predominant Private Sector investors in national research. Especially countries where foreign SMEs (which typically do not even have a very pro-active attitude towards getting involved in research policy in their home countries) play an important role should seek appropriate ways to understand the needs and perceptions of this group and to account for them in their research policies.

5. Barriers for effective and efficient Private Sector interaction

5.1 Types of barriers

In recent years, continuous progress has been made in the involvement of the Private Sector in research policy decision making. But our analysis has also shown current limitations and a need for pushing the frontiers of this interaction further to maximise leverage from it for the benefit of both sides.

This study has identified five groups of actual and potential barriers with different sources and nature. Figure 24 depicts the differences between these groups, which are described in detail in Chapters 5.2 to 5.6.

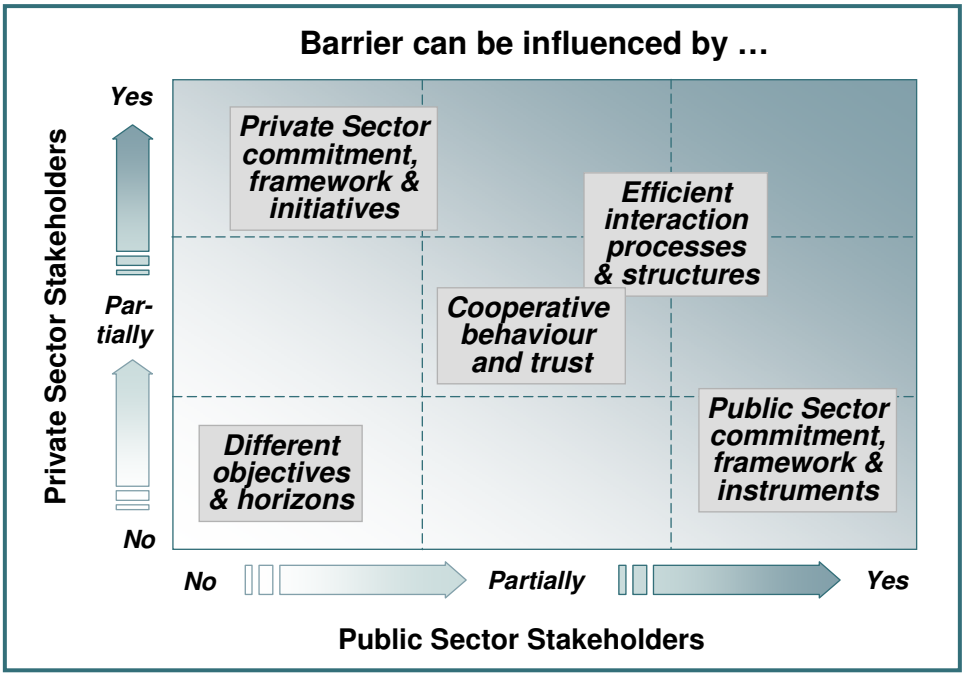

Figure 24: Types of barriers to efficient Private Sector interaction in research policy decision making

Depending on the individual situation of countries, such barriers occur to a different degree, as a function of the characteristics of the National Science and Innovation System, the underlying overall policy framework, socio-cultural background, economic structures, historically grown policy making processes, etc.

Some of them, but not all, can be influenced directly by policy instruments, while others depend on indirect measures or on changes in behavioural patterns or the underlying communication culture. This is especially the case for the improvement of processes and structures at the interface between Public and Private Sector, for changes in the policy and economic framework and for the underlying communication culture.

5.2 'Intrinsic conflicts': Different objectives, planning horizons and decision processes

Inevitably, the different perspectives and objectives of Public Sector and Private Sector stakeholders regarding their policies and strategies, respectively, lead to a "natural" mismatch in their expectations, objectives, strategies and behaviour in research policy decision processes. For such intrinsic conflicts of interest there is no obvious 'remedy'. Policy makers tend to focus on wide-ranging research policy initiatives to achieve micro- and macroeconomic effects for the benefit of societies and on instruments to achieve them. In contrast to

this decision horizon, Private Sector managers are primarily preoccupied with the achievement of short to medium term market and financial targets. As a result, expectations, strategies and behaviour of both parties do not always match at the research policy interface. This leads to the following barriers:

- **Different objectives**

  The potential for consensus and collaboration is limited by the different needs and expectations of the parties involved. To meet their market and financial targets, set by owners and shareholders, Private Sector decision makers tend to focus on R&D issues which have a measurable direct impact on their own new product development and competitiveness. In contrast, research policy has to consider the total of long term basic and applied research domains for the advance of science and society. Obviously this includes finding a balance between different scientific domains and avoiding research support measures which would distort competition or neglect the principle of subsidiarity.

- **Different time horizons and planning cycles**

  The typical time horizon of commercial strategic and R&D planning creates a mismatch of planning cycles: The Private Sector's strategic and operational planning is typically focussing on a short- to medium term planning horizon and revolves with a planning periods of months to several years. Long-term exploratory or basic research issues (which are the basis of Public Sector policy directions) are typically not a corporate planning priority (see Figure 25).

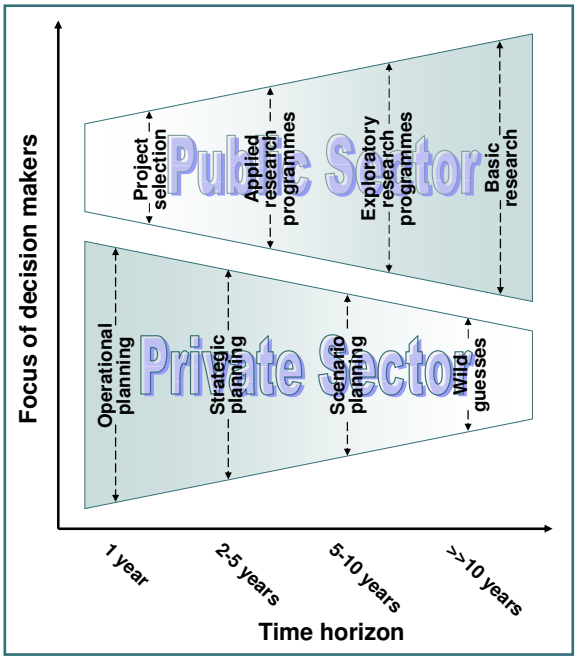

Figure 25: Different decision and time horizons of Public Sector and Private Sector stakeholders

- **Incompatible decision processes**

  Corporate strategic decisions are typically taken in a pragmatic way by the responsible managers, while policy decisions need to account to a greater extent for consensus building among various stakeholders involved.

  In addition, once decisions are taken, feedback loops are very different. The relevance and success of corporate strategic decisions is proven rapidly by revenues from new products, market shares, etc. Typically it takes much longer to see if for example a research programme to explore the potential of a new scientific discovery yields tangible benefit. And the results of such programmes are often much more 'fuzzy' since they can not be expressed in simple, measurable numbers.

- **Ownership and confidentiality issues**

  By its nature, the results of Public Sector research have to serve society as a whole and to be available to all stakeholders and to society as a whole. This creates obvious conflicts of interest and limitations for the participation of individual Private Sector companies which have to optimise their own position and to protect their knowledge against competitors. This may limit their willingness to contribute to initiatives where they fear for example that they would have to share knowledge and intellectual property from research with competitors.

5.3 Public Sector-specific barriers

As already explained, the Public Sector is not a monolith, but usually encompasses a multitude of actors with heterogeneous opinions and objectives. As a consequence, Public Sector-internal conflicts of interest and inefficiencies may occur. Other barriers, stemming from the underlying structures, bureaucratic and political frameworks add to this.

The following barriers have been identified as being of particular importance in our analysis:

- **Lack of commitment to enhance Private Sector involvement**

  In most interviews which we conducted, we observed a broad consensus on the importance of Private Sector interaction. Yet, this verbal commitment has not always been followed consequently by initiatives visibly dedicated to improve this interface. This impression is confirmed by the OMC working group on the Public research base and its links with industry which states:

  > *In the former context, there are few specific schemes to get Private Sector firms more interested in the possibilities of the benefits of undertaking R&D. This remains a significant barrier and is fundamental to all the other schemes and initiatives mentioned in this report.*
  >
  > *(Source: CREST 2004b)*

- **Lack of appropriate indicators and feedback**

  When discussing the issue of Private Sector interaction in research policy making during our interviews, many policy makers we interviewed agreed spontaneously that this issue was important and that further improvement was necessary. But policy makers seem to have little (measurable) evidence on where exactly they stand relative to their ambitions and to comparable countries or regions. This lack of indicators and benchmarks makes it difficult to assess the effectiveness and efficiency of specific approaches, to agree on improvement targets and to monitor their degree of achievement.

- **Lack of comprehensive 'ownership'**

  In most countries, the responsibility for research policy and related policy domains is dispersed. Oftentimes, one federal ministry is responsible for research policy while another one is responsible for innovation policy (and maybe a third one at federal or non-federal level for higher education). Each of these 'process owners' has separate decision processes, his own networks and his own approach to Private Sector involvement.

- **Public Sector-internal interdependencies**

  The complex interdependencies between political and administrative institutions are difficult to understand from the outside and can create a Public Sector 'black box' which is difficult to anticipate and influence for Private Sector stakeholders. For example, the election cycles of parliaments can create cyclical changes in political frameworks governing research policy and other policy domains. For the working relationship between responsible ministries and the Private Sector, this can create an element of instability and uncertainty. Another possible instability can arise when policy decisions which are relevant for research require the consent of other ministries with different agendas. For example, a research ministry's dedication to introduce tax incentives to stimulate Private Sector research may not be enough to overcome other priorities of economic and financial ministries preoccupied with stagnating public budgets, etc.

- **Fragmentation and complexity of administrative structures**

  Our stakeholder analysis has revealed the multitude of Public Sector actors involved in research policy decision making and the resulting complexity of Public Sector internal decision processes (see page 26) The OMC working group on the Public research base and its links with industry confirms this observation:

> *In some countries, the complexity of structures and decision processes and the multitude of actors involved in research policy decisions creates a significant hurdle for efficient interaction. Private Sector stakeholders have to address their messages to a variety of potential 'addressees' sometimes even with unaligned or conflicting objectives and approaches. This creates at least extra communication effort, in some cases it makes even efficient involvement very difficult.*
>
> *(Source: CREST 2004b)*

- **Time-consuming and compromise-oriented decision processes**

  Possible inefficiencies of Public Sector-internal decision processes aggravate the mismatch in time and strategic planning horizons and management cultures between the Public and the Private Sector. To be able to act efficiently themselves in dynamic markets, Private Sector companies require clear and unambiguous decisions. The time needed by Public Sector decision processes and compromises imposed by their consensus orientation do not support this action-oriented decision approach which enterprises seek.

5.4 Private Sector-specific barriers

Unlike the Public Sector, Private Sector decision makers are not responsible for research policy decisions and have little influence on the Public Sector barriers described in Chapter 5.3. But our study has confirmed a concern which was raised already by other sources: Private Sector stakeholders' awareness of and articulated interest in R&D and in particular in research policy still needs to be raised in certain fields. The conscience that research policy involvement is beneficial for both sides, but needs an upfront investment should be further propagated among Private Sector actors. The often complex structures on the Private Sector side constitute another group among the actual or potential barriers which we have identified:

- **Awareness and recognition of research policy involvement as a priority**

  During our analysis, we often encountered a confined group of companies with a sustained commitment to participate in research policy making. These 'usual suspects' are the active participants in research policy decisions, motivated by their specific needs and equipped with the necessary policy know how. In contrast, the remaining group of enterprises still needs to be sensitised for the importance of getting involved in Public Sector research and related policy making. The OMC working group on the Public research base and its links with industry states:

  > *'However, it was emphasised that for Private Sector firms to more actively participating in shaping public research activities, belies a more fundamental prerequisite, namely that firms need to recognise the value of R&D more generally for them to then feel it worthwhile to participate in influencing the nature and extent of public R&D activity. Thus, active participation requires, in addition, awareness of the value and benefits of R&D more generally. Large sections of the Private Sector, particularly Small and Medium-sized Enterprises (SMEs) and service enterprises, do not recognise the value of undertaking R&D and therefore many good opportunities for research and innovation are ignored and lost. This group of firms is also very likely to be overlooked as possible participants in Public-Private-Partnerships.'*
  >
  > *(Source: CREST 2004b)*

- **Conflicting corporate objectives and trade-offs**

  For Private Sector companies, research is not a goal in itself. From the viewpoint of managers, it rather is one of several means to help achieve the overall strategic and financial goals. Often it is not even the top priority of senior management. Inevitably, corporate research and research policy contributions compete internally with other action fields for scarce resources and capacities. As a consequence, the base of companies which are active in collaboration with Public Sector research (and often also engaged in research

policy interaction) is still too small[58]. Many companies either claim that they are too small to 'afford' an active participation. Others are caught in a vicious cycle: As they are not involved in research and research policy (and usually have also no experience with research collaborations, know how transfer, research funding programmes, etc.), they are unlikely to benefit from it. And because there is no visible benefit, there is also no incentive and motivation created to change this behaviour.

- **Unbalanced political power and participation in research policy making: Is there an 'SME problem'?**

  The obstacles described in the previous paragraphs have another critical consequence. Both the motivation and possibilities to participate in research policy making are not evenly distributed among Private Sector companies. Typically, enterprise engagement tends to be more intensive in research intensive sectors. But it varies also largely as a function of company size, strategic focus, technology intensity and regulatory environment.

  Corporate size plays a predominant role, because only large multinational companies (and to some extent also larger medium-sized companies) have the resources to build dedicated own research policy competency. For example, the DaimlerChrysler group maintains a specialised department *Research Policy and Communications*, which is part of corporate Research and Technology and reports directly to the responsible board member[59]. Among other tasks, this department is in charge of coordinating and spearheading DaimlerChrysler's participation in policy working groups and institutions and of communicating the company's views in public and institutional research policy debates.

  In contrast, the limited resource base of SMEs does not permit them to maintain a permanent research policy competency base and a continuous participation in research policy making. This is limiting in particular the possibilities of micro-enterprises with less than 10 employees (which constitute 93% of European enterprises and 34% of private employment) to participate in research policy issues[60].

  As a consequence, imbalances in the representation of Private Sector interests vis-à-vis policy makers in research policy related communication and decision processes can occur, favouring those groups which take an active stake[61].

- **Biases introduced by economic demography**

  In Chapter 4, Finland was quoted as an example of a successful economy with a high share of its technology and research intensive sector (see page 64). But at the same time, this Finnish example shows also the challenges of such an economic structure, stemming from the dominance of the ICT sector, which creates certain economic and research policy dependencies. There is a danger that this leads to a 'monoculture' in the interaction between Public and Private Sector if policy makers do not find the necessary balance between the demands of this dominating sector (which is the obvious driver of current wealth and growth), the maintenance of a balanced national R&D portfolio and the necessity to initiate a necessary renewal of the industrial structure if such a dominating sec-

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58 An indication for this problem is provided by the fact that many of the interaction platforms we encountered during our analysis (e.g. advisory bards, ad hoc working groups) are dominated by representatives of a limited number of large companies which have an obvious interest in influencing research policy.

59 see Katzenbach 2004 and Soboll 2000 for details

60 In the same way as they limit their possibilities to participate in research policy making, the limited resource and competency base of small companies is also creating disproportional administrative burdens in other areas for them. Current initiatives undertaken by a variety of member states to reduce these burdens might also be relevant for a further discussion about specific measures to enable more policy involvement of SMEs (see for example EC 2004 for details).

61 The OMC working group on the Public research base and its links with industry confirms this problem and states that '… care should be taken that certain narrow interest groups should not hijack such foresight and policy shaping initiatives' (CREST 2004b).

tor matures. In such situations, an important task is to draw the attention of both sides to the need for an appropriate research policy-oriented interaction with other sectors' Private Sector stakeholders[62].

- **Lower-technology and service sector gap**

  The economic structures of OECD countries have moved towards high-technology sectors and services. But in large sectors of the European economy, research still plays a minor role compared to other factors in sector and corporate strategies for sustained competitiveness. And despite annual growth rates for service related R&D above those for manufacturing in almost all OECD countries[63], the service sectors still represent a much smaller share of R&D than of GDP in general. The gap in these sectors is not only visible in R&D expenditure, but also in Private Sector interaction in research policy making. Out observation is that in the current interaction, the Private Sector is still mostly represented by the technology-intensive manufacturing companies which have spearheaded this development.

  Possible reasons for this failure to get more involved in Public Sector research and related decision making should not be attributed only to a persisting focus of research funding on traditional research areas. Enterprises in these sectors also lack an established tradition of partnering with Public Sector research and of getting involved in related policy issues. And their structures also do often not favour such an engagement, because frequently there is no clear allocation of responsibility for research, nor is there dedicated organisation for taking care of it.

- **Partial need for further development of structures for Private Sector representation and internal alignment**

  In some of the countries of the European Union, particularly in those with high research intensity and a well developed Science and Innovation System, industry and sector associations have developed a high degree of professionalism and sophistication in representing the interest of their members in research policy decision making. But across Europe, the picture is still heterogeneous. In other countries (especially of the 'beginners' group), structures and processes for aligning companies' needs and perceptions and for representing their interests regarding research policies are still in early development stages or even in their infancy.

- **Conflicts of interest between subgroups**

  In some cases, it can happen that the Private Sector does not speak 'with one voice'. Typical reasons for such problems can include fragmented or conflicting needs and perceptions, for example between upstream and downstream sectors, between large companies and SMEs, etc. Such circumstances have also an impact on research policy contributions, as they comprise conflicting messages from the Private Sector. At the same time, this is also to the detriment of the Private Sector itself. If such statements contradict and/or offset each other, they may weaken the overall negotiation position and can hamper credibility.

- **'Polyphony'**

  A significant challenge arises from the fact that the Private Sector does typically not have a monolithic structure with unified needs, opinions and interests. Consider the value chain of chemical products. The chemical industry which develops and produces new chemical substances with large own R&D efforts has other research needs and expecta-

62 See the country report Finland for how the country deals with this challenge

63 Paragraph based on OECD 2005b. According to this source, Denmark (40%), the Czech Republic (35%) and Norway (33%) are European leaders in service R&D, while other important countries like Germany still have a share of services R&D of less than 10%. Ireland had the most notable difference in R&D growth rates for the two sectors: between 1993 and 2001, Irish R&D increased by 27% in services (mainly driven by growth in computer services) and by 7% in manufacturing.

tion for Public Sector research than the 'downstream' sectors which incorporate these chemical products in their own products, based on different types of R&D (e.g. plastics) and 'end user' industries (e.g. automotive)[64]. Other possible Private Sector-internal conflicts can occur if dominating competitors can not agree on a joint industry agenda or if large industry interests contradict SME needs.

- **Lack of incentives for a sustained commitment**

  As long as research policy deals with issues of direct relevance for an enterprise, it is obviously motivated to participate in research policy decision processes. But as soon as this incentive becomes less apparent (or even disappears, for example if the specific research policy topic of interest for the enterprise is resolved), the willingness to participate further in research policy-related communication processes may vanish. This makes the commitment to participate in research policy interaction a temporary one if there is no other motivation for further participation. An unpleasant consequence of such decisions can be a 'fly-in-fly-out' of Private Sector actors in the interaction process which endangers the Private Sector's overall credibility and the efficiency of the interaction processes.

- **Limited availability of key individuals**

  Valuable contributions to the interaction require experienced and senior Private Sector representatives who have also the necessary seniority to be able to speak for their industry, sector, etc. in a credible way and to act as 'multipliers' who can efficiently disseminate and promote the concepts and ideas developed in the collaborative interaction processes. Since such individuals usually typically have full agendas and a multitude of other commitments, their availability can become a considerable bottleneck, especially in smaller and less research-intensive economies[65]. This is the case especially for the limited number of Private Sector executives with professional experience in the Public Sector (or Public Sector representatives with professional experience in the Private Sector) who are in a particularly strong position to help build bridges between both worlds.

5.5 Process, structural and cultural interaction barriers

In the shared zone of interaction, where either side can take the lead in initiating the interaction, bringing it forward and providing the necessary platform and inputs, special problems can occur:

- **'Clash of cultures'**

  To avoid misunderstandings and to ensure an efficient interaction, Public and Private Sector actors must develop a common language. This is not the case from the beginning: Public Sector representatives tend to think and speak in administrative terms while Private Sector representatives tend to look at issues discussed from a business perspective and to use their own corporate terminology. This is less of a problem if interaction mechanisms are well established and if organisations and individuals involved have experience with this type of interaction. But it can become a challenge during the introduction of new interaction mechanisms (especially in 'beginner' type economies with no or limited tradition in Private Sector interaction) or if new actors enter the stage.

- **Hidden agendas and mismatch of expectations and attitudes**

  All participants in the interaction process represent primarily their own sectors and institutions. Their behaviour is governed by a complex set of objectives, restrictions and rules

[64] A recent example for this type of Private Sector internal coordination need are the negotiations concerning the new European chemical substance policy REACH, where obviously the chemical industry has other interests than the 'downstream' sectors.

[65] In addition, the question of incentives arises also at this level. Our research during this study suggests that some top managers' sense of corporate citizenship and interest in long-term oriented networking creates sufficient motivation for them. But for those who do this, their engagement is related with trading-offs on their tight agendas.

which are defined by their prime responsibility in public or business administration. This is not a major challenge as long as there is sufficient transparency about these driving forces and as long as these forces do not limit collaborative behaviour. But mismatches can occur if for example one side is in a 'lobbying mode', geared towards gaining consent for already existing convictions and proposals, while the other side is in a 'joint learning mode'. Such a mismatch can jeopardize the entire interaction process and prevent exchange of valuable contributions and joint learning.

To prevent such mistakes, well-established interaction platforms with experienced actors have developed clear 'rules of the game' and choose their participants carefully. However, this still represents a considerable challenge for 'beginners'.

- **Lack of empowerment**

  The designers of the Dutch advisory structure (described in the case study on page 23) have consciously equipped their key advisory bodies with important rights to claim information, solicit support and request replies to their statements. Without such an empowerment, the success of such advisory bodies depends on the goodwill of other institutions to cooperate, to listen to advice provided and to implement recommendations.

- **Lack of support**

  Except for industry lobbyists, Public/Private Sector interaction at the research interface is not a full-time job. Top-level policy makers and Private Sector managers can only devote a limited part of their time to this task. To work together efficiently in advisory boards, steering committees, etc., they must be able to delegate work and build on a professional preparation of their work. In the absence of such professional support, the interaction in advisory institutions, etc. may not reach its desired effectiveness and efficiency.

- **Insufficient management of the interaction interface**

  The multitude of possible approaches to involve the Private Sector in research policy decision making described in chapter 3 and the challenges associated with their successful selection and use suggest that a high level of awareness of these instruments and a certain degree of professionalism in their application is helpful, if not necessary. In reality however, many of the currently existing interaction mechanisms have evolved historically and/or are tied to specific individuals or entities which promote them. As a consequence, the interaction and the chosen mechanisms and instruments to support it may or may not be sufficient, appropriate and managed efficiently.

- **Lack of experience**

  Due to the historical absence of research-intensive sectors of the economy or due to a disruptive political development, some countries did not have the opportunity so far to develop a full fledged research policy framework and the related Private Sector interaction tradition. As a consequence, they do not only lack the necessary experience and skills. In addition, they also still have to go through a cultural change to make Private Sector actors aware of the need and benefits to get involved in Public Sector research and to help Public Sector administrations to overcome historically grown, inward looking attitudes which hinder their openness for Private Sector interaction.

- **Inertia**

  The introduction of modern mechanisms for efficient Private Sector interaction may require radical changes and streamlining of existing decision processes. In addition, radically enhanced Private Sector influence on resulting research policy may also induce important changes in these research policies. As discussed in the background paper (Appendix, Chapter A4.3), such third-order change can encounter severe resistance in established administrative structures, especially if such requested change is not underpinned by an actual crisis which renders the need for radical change most evident.

To conclude this section, we would like to express a word of caution:

During our analysis and interviews the impression prevailed that all participants in the interaction processes respect the 'rules of the game', are fully aware of their responsibility to maintain a basis of trust in the relation and deal with this issue in a highly professional and responsible way. Abuse of the other side's trust can have a drastic impact! Most of the formal interaction mechanisms which we have explored only work well in a collaborative set-up. And the informal part of interaction depends even more on a trustful relationship. Once lost, trust is difficult to rebuild.

5.6 Specific barriers and challenges of Central and Eastern European new member and candidate countries

The transformation of the economies of Central and Eastern Europe (CEE) has been accompanied by profound changes in the structures and patterns of their Research and Innovation Systems and policies[66]. One of the key challenges which CEE countries faced in recent years was to overcome the vicious circle created by the heritage of their previous command economies, which focussed on research budget allocation with little attention for the creation of technological competencies and for their value for national societies and economies. Furthermore, little emphasis had been placed on the integration into international scientific and economic communities. The resulting main shortcoming is an imbalance between the resources and potential of such National Science and Innovation Systems and their current economic efficiency and impact. Another danger is a 'downward spiral' where a lack of financial resources and incentives for researchers causes an under critical mass of research potential. This in return endangers the desired positive impact of the Science and Innovation System on the innovation and economic performance of the national economy and its commercial enterprises[67].

Policy makers are increasingly aware of the need to include the Private Sector in the restructuring of public research infrastructures and the modernisation of public research governance systems which is under way[68]. This has led in most countries to a first generation of approaches to Private Sector involvement. The forerunners in this group have now a first generation of interaction processes, structures and instruments in place and work on refining them. Yet, in other countries, these approaches are still in their infancy and need increased attention and commitment as well as further systematic development and transfer of relevant concepts and experience from other countries.

Beyond the general barriers outlined in the previous sections of this chapter, most new member and candidate countries face particular additional challenges:

- **Awareness and basic knowledge of approaches to Private Sector interaction**

  The relevance and importance of this study's topic is illustrated by its direct effects on policy making: In some cases, interviews with policy makers in the context of this study raised immediate interested in the topic, created a demand for follow-up information and, e.g. in the cases of Hungary and Poland, contributed to the dedication to reinforce the current first generation of approaches for Private Sector involvement.

66 For detailed discussions of related challenges and the current situation in selected CEE countries see for example Inzelt 2004 and Inzelt 2002.

67 This effect is described by Bazhal using the example of the Ukrainian innovation system (Bazhal 2002). But similar patterns apply also to other countries in comparable situations.

68 It should be noted that CEE new member and candidate countries differ in terms of their achieved progress in market oriented reforms, in the relationship between the state and Private Sector enterprises, in their investment climate and in their institutional development. Therefore the specific challenges and barriers outlined in the following section apply to a different extent to countries which benefit from a newly developed and sound investment climate (e.g. Hungary) and to those which still need to catch up.

- **Public Sector institutional and policy framework**

  In many CEE countries, research policies, underlying Public Sector decision processes and instruments for Private Sector interaction are still in development, in some cases even still in their infancy stage. As a basis for a sound, balanced interaction between both sides, the necessary reforms of Public Sector research policy governance systems and their interfaces with the Private Sector should be accelerated.

- **Cultural and institutional barriers on the Private Sector side**

  In previous command economies, companies were executing plans prepared by central authorities. They were usually not involved in policy formulation and decision making. Therefore, interaction can not draw on a historically grown 'culture of interaction' with validated and accepted roles and mechanisms. In addition, the necessary institutional framework for efficient Private Sector contributions (e.g. industry associations, special R&D working parties, etc.) is still in its infancy in many CEE countries.

- **Industrial structures**[69]

  Traditional industrial structures have been weakened as many of the previously existing companies have become obsolete in the course of national restructuring. In many countries, foreign direct investment has become the major source of growth, particularly in research-intensive high-technology sectors. However, multinational companies investing in capacities in CEE countries usually have already established R&D centres and networks. Therefore their interest in new R&D investments and in contributing to their local innovation environment is often very limited.

- **Science and Innovation System limitations**

  To go beyond investments with little research and technology content (e.g. pure manufacturing plants), investors typically look for access to existing, efficient R&D capacities, innovation networks and clusters and for a stable, reliable human resource base. In view of the development outlined on page 76 this may become a deadlock, because without an appropriate research and funding base, states can not guarantee such an environment.

- **Imbalances in the possible impact on research policies**

  In the established science and innovation systems of western countries, an equilibrium between the different stakeholders and the way how they represent and pursue their interests has emerged over time and stakeholders had the time to establish and learn the 'rules of the game'. In difference to this situation, the rapid and radical change from a centrally planned economy to a market economy in the Central and Eastern European new member and candidate countries has created a certain 'vacuum' in certain cases: (1) Policy makers had to master radical changes in the economies without having the necessary instruments and experience available; (2) national Private Sector enterprises, in particular SMEs, had no experience and tradition at all in understanding the importance of research and innovation policies for their own competitiveness and in getting involved in these. At the same time, multinational companies investing in such countries typically have a very proactive behaviour and are very experienced in research and innovation policy-oriented interaction. This can bear the danger that national enterprises, especially SMEs can not always make themselves heard in the policy debate to the necessary extent and that resulting policies are geared in an unbalanced way towards the needs of specific groups, while national SMEs might have a particular need for help to catch up with European and global research, innovation and competitiveness standards.

[69] This paragraph focuses on industrial issues which are specific for CEE countries. A part from this, industry and SME's in CEE countries encounter the same challenges as others which were already described in sections 5.2 to 5.5.

Case study Hungary: Pázmány Péter – Regional University Knowledge Centre programme in Hungary

In the course of the fundamental restructuring of Central and Eastern European economies, historically grown mismatches between the different components of innovation systems have to be corrected. To overcome in particular the historically low level of co-operation between Public Sector research and enterprises, Hungary and other new member and candidate countries have to re-code existing institutions and introduce new elements in an attempt to create the proper economic environment for the successful transfer of research results into innovation and economic growth.

In a first period of this transition, the basic elements of a re-designed Science and innovation government framework were established, including the majority of new laws and a modern governance framework for Hungary's S&T system. The objective to stimulate Private Sector R&D and its demand for cooperation with Public Sector research was also on the government's agenda since the beginning. But only in 1995 the first programme which supported this interaction could be launched, followed by other policy initiatives. Since approximately 2000, a second wave of new legislation, paralleled by newly initiated programmes continues to pursue this goal. Calls for feasibility studies and for infrastructure development launched by the responsible ministry emphasised the close collaboration between Public research and Private Sector enterprises. Thereby, a joint thinking on strategic issues and a positive impact on collaborative R&D was achieved already in the preparatory process.

As a centrepiece of this new initiative, the *Pázmány Péter – Regional University Knowledge Centre programme* was initiated in close collaboration with regional authorities and Private Sector representatives. Its objective is to position universities as magnets for regional development, which attract leading-edge industries, stimulate the formation of innovative clusters and strengthen the capabilities of regional business in different corners of the country. Two calls for proposals were launched in October 2004 and in April 29, 2005. These attracted 12 and 15 applications. The winning 12 consortia have 91 members from the business sphere (among them 48 large firms and 43 SMEs) and have established a multitude of partnerships with other small businesses from their regions. Business consortium members have added 1.5 to 2 times the amount of government grants to research budgets and have declared their willingness to invest more and launch additional joint projects. These winning clusters cover almost all geographical parts of the country and important innovative growth sectors of the economy.

Because of the short history of the programme, only a first rough assessment of the achieved effects can be given now[70]. But available indicators show that the programme has stimulated the involvement of large business in financing and performing collaborative R&D as well as SME participation, significantly contributing to the development of their technological skills. The realised university-industrial co-operations and their incubation function have a positive impact on the region's innovation and economic development. An additional important 'side effect' is the modernisation of universities. Interdisciplinary collaborative research strengthens at the same time their orientation towards result-oriented long-term targeted basic research and stimulates the renewal of their organisational structures and governance frameworks.

Taking into account the learnings from this initiative (including those from the 'trial and error' approaches leading to this current programme), the successful start of the programme makes it an attractive model for other countries having shortcomings similar to those in Hungary's innovation system.

[70] An intermediate evaluation is under way, but results will only be available after the end of this study.

6. Recommendations

6.1 Overall recommendations

This study confirms the importance of Private Sector involvement in Public Sector research policy decision making. For such an efficient interaction, well-designed processes, structures, mechanisms and instruments, a supportive environment and the commitment of policy makers and stakeholders are necessary. This leads to the following general recommendations:

- *A strong dedication to effective and efficient Private Sector involvement in research policy decision making should be made an **integrated part of the governance of national science and innovation systems.***
  - *Research policy makers should invite and solicit **Private Sector interaction in their decision processes** for the enhancement of quality and acceptance of policy measures. They should identify research policy areas with a need for interaction, choose and implement appropriate instruments and ensure efficient internal decision processes and openness for Private Sector contributions.*
  - *Private Sector actors should develop a broad **awareness** of the need and benefits of being involved in research policy decision making, **identify priority research policy areas** where their involvement is crucial and allocate a sufficiently high **priority** to their active interaction in related decision processes. This includes both own initiatives and participation in Public Sector initiatives.*
- *In the design of this interaction, both sides should set **priorities** on policy areas where interaction is of particular importance, define **target level and target results of the interaction** and choose **approach and instruments** accordingly. This includes **supportive framework conditions** and – where necessary – the enhancement of a mutually supportive and trustful **communication and collaboration culture**.*
- *To assess their current position and improvement potentials, both Public Sector and Private Sector actors should undertake – where appropriate – a thorough **review** of the current level, efficiency and achieved impact of their interaction in the research policy field. Depending on the outcome, they should define **priorities and improvement targets** for the enhancement of this interaction. This may include for example a streamlining of decision processes, the introduction of new instruments or a cultural change of an existing communication culture.*

When reviewing the current status of Private Sector interaction and choosing approaches for its development, policy makers and stakeholders should also be sensitive to the development stage of the science and innovation system and of its Private Sector interface[71].

Beyond these general recommendations, the study points to specific improvement needs to develop the current state of the art further towards the desired level and quality of interaction. However situation and improvement priorities vary considerably from country to country, depending on prevailing situation, economic and Nation Science and Innovation System structures, historically grown research policy decision processes, etc. Therefore each country must define its own individual national pathway for improvement.

In a first step, policy makers must decide on the necessary level and scope of change:

(1) The first (and least radical) approach is an *incremental improvement* of existing decision processes, policy and institutional frameworks. This may include for example the streamlining of decision processes, the extension of current Private Sector involvement to additional research policy areas or issues, the introduction of new Instruments for Private Sector involvement, etc.

[71] See Chapter 4.2.

(2) If tinkering with existing processes and frameworks is not sufficient to achieve the desired improvement of Private Sector interaction, a more radical renewal of existing decision processes, policy and institutional frameworks should be considered. This type of reform may for example create new institutions for Private Sector involvement or stimulate the introduction of a legal framework defining obligations and rights of such platforms (as for example in the Netherlands). Such highly visible interventions can act as a signal, demonstrating the commitment of policy makers and thus stimulating positive reactions from the Private Sector and other stakeholders.

(3) Third, a change of decision making and communication culture within government and at the interface may also be crucial if for example current cultural and behavioural barriers hinder an efficient interaction. However, experience with many change management projects suggests that a sustainable cultural change requires a sensitive, yet effective approach and creates tangible improvement often only in the longer term.

(4) An investment in the Private Sectors' capabilities to contribute in a credible way to research policy making is a final area for action. This seems to be especially relevant for countries of the 'beginners' type, where the necessary structures and competencies, for example on the side of industry associations, are still in an infancy stage. Possible measures include the creation of awareness, the promotion of research networks and support of capacity building in Private Sector organizations.

Once these decisions about level and scope of change are taken, policy makers and Private Sector actors have to choose priority areas, where they wish to establish new forms of interaction or to improve existing ones. In doing this, the target group specific recommendations outlined in chapters 6.2 to 6.4 may be more or less important, depending on the specific situation and needs.

6.2 Recommendations for policy makers

6.2.1 General recommendations to strengthen the interaction with the Private Sector in research policy decision making

Experiences during our study suggest that effective and efficient Private Sector interaction in research policy making does not occur spontaneously. It requires a dedicated effort to gain commitment and to build efficient processes, structures and instruments.

Necessary reforms should define or improve objectives, instruments and formal parameters of the Public Sector policy framework, design or improve interaction processes and provide incentives to enable and stimulate a credible commitment of Private Sector stakeholders and a constructive interaction. This includes the following fields of action:

- **Promote sustained and visible commitment to Private Sector involvement**

  To achieve the desired leverage from Private Sector interaction and to make it a credible concern, a visible and durable commitment of policy makers is the utmost prerequisite. To be credible and efficient, such an involvement should be seamless, throughout the entire decision chain from instigation to assessment as outlined in Figure 30. Public Sector actors should therefore make Private Sector involvement an explicit part of their agenda, communicate this proactively and define objectives for their targeted progress in achieving this.

- **Ensure "one face to the stakeholder"**

  Chapter 5.3 had pointed to tensions and possible inefficiencies in research and innovation policy making caused by differing or even competing rationales of individual policy domains, ministries, etc. The recommended credible and efficient mechanisms to balance such views and policy approaches are also a 'must' for efficient Private Sector interaction. If the Public Sector sends conflicting messages to its partners in the policy

making processes and if these have problems to identify the right addressee for their statement an efficient interaction becomes unlikely.

- **Apply a context-specific approach to involve the Private Sector**

  Reasons for involving the Private Sector, expected contributions and mechanisms for involvement may vary considerably, depending on the type of research policy decision and on the existing structural and policy context. Another aspect is the type of partner involved on the Private Sector side and the development stage of this relationship. For example, interaction with Private Sector partners experienced in collaboration with Private Sector research and involvement in related policy making can take place at a different level than interaction with 'beginners' with limited resources in this field. Therefore policy makers might consider the approaches described in Chapter 3 as a 'toolbox' from which they can choose in a flexible way the best approach, depending on the specific situation.

- **Mobilise a larger Private Sector base for active participation in research policy making**

  The recommendations for the Private Sector in Chapter 6.3 mention among other the mobilisation of a larger enterprise base for active research and research policy interaction. Even if – at a first glance – this seems to be a Private Sector issue, policy makers can and should contribute to achieving this objective. Our analysis has shown that initiatives like foresight exercises are capable of creating a high level of awareness among actors which traditionally did not have research (policy) issues as a priority on their agendas. Therefore, Public Sector actors should consider measures which help to mobilise Private Sector actors, including joint initiatives, for example with industry or sector associations.

- **Safeguard a sane balance between different types of Private Sector participants in research policy-related interactions**

  Chapter 2.1 pointed out that the limited resource base and more short-term oriented time horizon and research/innovation activities of SMEs impose limitations on their capabilities to participate in research policy-related debates and related activities. An absence of an appropriate SME 'voice' can lead to an imbalanced representation of Private Sector views and needs in research policy-related interaction with policy makers. Therefore policy makers should examine their current portfolio of Private Sector interaction and establish appropriate support measures to enhance SME participation if appropriate.

- **Build responsible and trustful relationships with the Private Sector**

  As the detailed discussion of research policy decision processes in Appendix A4.3 points out, the efficient application of formal instruments depends to a large extent on a sane informal interaction. This 'human side' of the interaction is essential to ensure a responsive, collaborative and constructive behaviour of all involved actors. Many of the interviewees of this study have emphasised in particular the importance of mutual trust. This requires an ethical code of conduct (as one of them expressed it: "They know that we are not cheating and playing games with them") and a high degree of transparency of the motivation and objectives of both sides and the way how they represent their positions in the interaction.

- **Enable seamless and transparent decision making with anchor points for Private Sector interaction**

  Reduced complexity and enhanced transparency of decision processes are an important determinant for an efficient interaction. Therefore policy makers should strive to streamline their decision processes and to make them as transparent as possible. Since the Private Sector usually is not one of the ultimate decision makers and its involvement focuses on specific elements of the overall decision process, there must be well-defined anchor points where these contributions can be fitted into the overall decision process. These can range from an established continuous dialogue and consultation mechanisms

in the instigation and design phase to institutionalised mixed advisory and steering committees with formally defined obligations and rights.

- **Develop dedicated approaches for Private Sector involvement**

  Ensuring a continued Private Sector interaction throughout the research policy decision chain and for all important research policy areas at the desired level can not be achieved with a single 'one fits all' approach. This requires a set of target specific approaches, each o them using the appropriate type of instrument and involving in an issue specific way the right stakeholders. To be able to choose the most appropriate one from the available portfolio of instruments for each case, policy makers should be made familiar with the concept of Private Sector interaction and the 'toolbox' described in Chapter 3 on a broad base.

- **Stimulate enhanced interaction on the operative research level**

  To enhance the interaction between Public Sector research and its Private Sector counterparts, research policy makers should further increase their support for measures which stimulate such interaction. This can happen on different levels, including for example the involvement of visiting professors with a Private Sector background in research and teaching activities, the development of research- and technology-driven regional or thematic clusters, etc.

- **Monitor status and progress achieved in Private Sector involvement**

  To ensure that the desired progress in Private Sector involvement is achieved, policy makers should render improvement goals and progress achieved explicit and transparent by defining measurable targets and monitoring progress. This could be done internally or alternatively on a trans-national base, for example using the platforms provided on the European level[72].

- **Avoid 'over-formalisation' and 'over-instrumentalisation' of the interaction**

  One of the most striking insights gained in the interviews during this project was the high emphasis which representatives of all involved parties put on informal interaction. Public Sector policy makers should remember this when working on the design of the Private Sector interface in their decision processes. Formal instruments like committees, consultations, etc. provide the framework for an efficient interaction. But without the necessary space for trustful interpersonal interaction and for the natural development of creative new ideas evolving from this direct personal exchange even the best-designed system will not come to life!

- **Balance economically oriented objectives with other research policy targets**

  Public Sector research encompasses a larger portfolio of research areas. Some of these are of high economic relevance and therefore attract Private Sector involvement, while others are of no or only limited interest for commercial enterprises. Beyond the commercial value of knowledge and results generated by research, policy makers have to observe also other research policy objectives, aiming at the enhancement of scientific knowledge and the solution of societal problems. Therefore, policy makers need an efficient approach to weigh the impact of (economically justified) Private Sector research policy needs and proposals vis-à-vis other research policy targets.

[72] See the European Commission action point 'Periodic monitoring, evaluation and peer review' on page 88.

6.2.2 A proposed approach to choose depth and type of Private Sector involvement

To be most useful for research policy making, Private Sector contributions should not arrive spontaneously or erratically in the policy decision processes. Therefore policy makers should undertake a conscious effort to stimulate such contributions and to shape the decision processes in a way that the desired interaction can take place in the best possible way. In the design or optimisation of research policy decision processes, policy makers must consider the need for – and the value and possible impact of – Private Sector involvement carefully. Questions which policy makers have to ask themselves address the target level, the design and the efficiency of this interaction:

(1) What is our overall attitude concerning Private Sector involvement in research policy decision making? Should we adopt and communicate a formal policy and communicate it as part of our effort to gain stakeholder commitment and to ensure coherency with other policy areas[73]?

(2) In which research policy area do we seek which level, scope and type of Private Sector involvement[74]?

(3) For each selected research policy area: What do we want to achieve from the involvement of the Private Sector? Which type of instrument should we apply? Which Private Sector representatives do we want to involve? How do we gain their commitment?

(4) Do we allow for the necessary informal interaction? Can we foster this further?

To answer these questions, the following suggested approach may be useful.

Step 1: Create and foster a culture of interaction

The practice of exchanging information and consulting together on a daily basis ensures that governments can come together with other stakeholders at short notice whenever necessary, often with prior knowledge of their respective views, in order to discuss policy options or to reconcile differences between them. Thereby, difficult decisions which may raise conflicting views or which face competing resource demands can be supported by credible arguments and take place in a cooperative atmosphere.

Step 2: Understanding the Private Sector Context and identify the relevant Private Sector stakeholders

To solicit valuable contributions from the Private Sector in search of policy decisions, policy makers must understand the context of the (potential) Private Sector contributors. Private Sector actors, whose world view is strongly influenced by the commercial boundaries of their own activities, may not recognize the overall value and use of their contribution in a much larger and complex research policy decision. In addition, it is important to identify the appropriate Private Sector contributors, to ensure their participation and to position their contributions correctly in the overall portfolio of inputs[75].

Step 3: Understand the value and limitations of Private Sector contributions for policy decisions

To assess the value and credibility of information and suggestions brought forward by the Private Sector their background must be understood. For example it is cru-

[73] In a larger view which goes beyond the scope of this study, the interfaces with other stakeholders and policy areas also have to be taken into account. For example, other stakeholders might oppose a preferential treatment of the Private Sector in some policy areas.

[74] See chapter 3.3 for criteria and suggested guidelines for this type of decision.

[75] A typical challenge in this context is to ensure an appropriate level of inputs from SMEs (See the discussion of this aspect on page 72)

cial to reflect the importance of the policy decision under discussion for the Private Sector and also whether this importance is different for specific groups. Furthermore, the intention behind Private Sector contributions needs to be considered. Are such contributions submitted as pure information, as a arguments in an ongoing open discussion or with the goal to support an already firm position? It is equally important to know the 'sender' of the information or advice and his specific intentions. Is he speaking for himself, for the entire Private Sector of for a specific interest group? Are there diverging views between organisations, sectors, etc.?

Step 4: Stimulate and manage Private Sector contributions

As the responsible 'process owners' of the research policy decision processes, policy makers should provide framework conditions which encourage Private Sector contributions and value them appropriately. A transparent policy decision process must provide stakeholders with an understanding of how their contribution adds to the decision and give them the necessary confidence that they are represented appropriately. This includes an efficient management of conflicts of interest.

Step 5: Obtain the right input at the right time from the right 'sender'

The relevance and utility of the information or advice provided and their possible impact on research policy instigation, definition and implementation depend critically on obtaining the right input at the right point in time. Therefore, policy makers should select carefully when they invite or solicit what type of contribution in which form. Addressing such invitations or requests to the right addressee is particularly important.

6.3 Recommendations for the Private Sector

6.3.1 General recommendations to strengthen further pro-active engagement in research policy issues

The Private Sector's current tendency to increase its engagement in the instigation, design and implementation of Public Sector research policy should be further enhanced through the following measures:

- **Commit to research policy involvement**

  When it comes to allocating resources to research policy engagement, corporate executives might see themselves as caught between

  - the need to focus all available resources on business activities which create short term profit and a long term R&D and related policy engagement which creates, at a first glance, only benefits in the longer term;
  - a 'corporate citizenship'-type activity with only indirect (e.g. public relations) merit, and a government-intervention-driven lobbying approach, focussing on the promotion of own special interests.

  Under the short-term pressure of financial targets and of shareholder expectations, corporate executives might easily be tempted to neglect the long-term benefits of a sound and supportive National Research and Innovation System. Instead of remaining stalled in such perceived conflicts, Private Sector decision makers should adopt a truly strategic attitude towards their involvement in research policy issues. Constructive participation in Public Sector research policy making can improve their competitive context - the quality of the business environment in the locations where they operate[76].

[76] See Porter 2002 for a detailed discussion of this argument.

Therefore, it is in Private Sector stakeholders' own interest to get involved in Public Sector research policy formulation and implementation actively and to work in a co-operative way towards 'win-win' situations.

- **Apply a context-specific approach to research policy engagement**

  The motivation of Private Sector corporations to engage in Public Sector research policy design and implementation and to devote resources to this interaction depends on their specific needs. Typically, companies in technology- and research-intensive, highly dynamic sectors have a high need for state-of-the-art public research results as sources for their own innovation efforts. Therefore it is particularly important for them to get involved in research policy formulation to make sure that its results contribute to achieving the Private Sector's objectives.

  Another aspect is company size. While large multinational corporations are able to set up own competencies and capacities for this purpose, SME's should seek ways to bundle their interests and/or focus their engagement on activities with particular importance to them.

- **Mobilise a larger Private Sector base for active participation in research policy making**

  During our analysis we observed that in many cases the voices of a limited number of Private Sector companies (usually large, technology and R&D intensive corporations) constitute the vast majority of Private Sector contributions to research policy formulation. This may lead to a bias towards the perceptions and interests of this subgroup of stakeholders. Therefore, it is important to mobilise a larger base of Private Sector organisations.

- **Safeguard a balanced representation of the Private Sector in research policy-related interaction**

  It seems particularly important to increase the awareness and commitment of those Private Sector subgroups and sectors which have not yet been involved to the same extent as large technology-intensive industrial enterprises. This may suggest for example special efforts to mobilise SMEs and/or enterprises from sectors which do not have the same tradition of being at the core of research and research policy-related interactions, for example from 'medium to low tech' sectors or from the service sector.

- **Extend Private Sector involvement to less research intensive and service sectors**

  To be innovative and competitive, enterprises in less research-intensive and in service sectors often count on other competencies than research and development. However, the example of the key role which modern information technology plays in the progress of most services shows that many of their key success factors depend at least on technological progress in related sectors. Therefore, Private Sector stakeholders in these sectors should recognise these indirect benefits and input from the R&D enterprises in other sectors into their own innovation processes and revise their current attitude of refraining from a more active involvement in research and research policy.

- **Speak with one voice**

  As outlined on page 73, different or conflicting objectives of Private Sector actors can lead to a highly uncoordinated, confusing 'tsunami' of (maybe even contradicting) research policy messages which are difficult to interpret by policy makers. In the worst case such contradicting messages can even offset each other, weakening considerably the overall position of the Private Sector. Consequently, industry associations and other Private Sector actors should undertake a conscious effort to align and coordinate Private Sector contributions to research policy. This does not have to mean complete alignment; inherent 'polyphony' stemming from different objectives is acceptable. But it should not result in confusing or blurred messages to policymakers.

- **Build committed and trustful relationships with the Public Sector**

  As is the case for the Public Sector, it is also in the interest of the Private Sector to build lasting relationships, based on a continuous exchange of views and information and on mutual trust. For this purpose, industry and sector associations should continue and enhance the current dialogue and corporations and individuals should make a conscious commitment, for example to be available as members of advisory committees, etc. Mirroring the Public Sector action point 'transparent decision making' in Chapter 6.2.1, the Private Sector should also undertake a conscious effort to make the genesis and line of thinking of his research policy contributions transparent for policy makers[77].

- **Take the initiative and come up with own creative ideas in important areas**

  Historically, the Private Sector has acted mostly in a reactive mode, responding to policy makers' proposals and inquiries. Examples like Avenir Suisse show that the proactive development of own innovative policy proposals can help to develop the Private Sector's role from this purely reactive position towards a proactive role, offering much more powerful opportunities to influence research policy.

6.3.2 A proposed approach to determine focus, depth and type of the Private Sector's engagement in research policy

Through its impact on innovation, research policy can affect corporate success in many ways. Therefore Private Sector companies should consider its effects systematically and consider carefully whether it is in their own interest to engage in its instigation, definition and implementation. There is an obvious trade-off: On one hand, such an involvement can help to influence policy decisions in a favourable way. On the other hand, such an engagement requires resources and capacities. Therefore companies need to decide:

(1) Should we seek involvement in research policy decision making?

The possible impact of research policy has an important influence on the decision. In some cases, the possible influence which research policies can have for the industry or for the individual company can make an engagement even a 'must'. For example the necessity to ensure more favourable framework conditions or an urgent need for improved transfer of research results can create a strong case for seeking involvement proactively. But even without such an urgent need, engagement in research policy making may be of value for companies, because it contributes to enhancing networks and builds goodwill by demonstrating responsible corporate citizenship.

(2) Does it support our corporate goals? Can we justify the necessary investment?

(3) If yes: To which research policy areas and decisions do we want to contribute? With which objectives, views and ideas?

(4) Which his the best way to represent our perceptions, requirements and suggestions in research policy debates and decision processes?

To answer these questions, Private Sector decision makers may refer to the following suggested approach[78]:

Step 1: Understand the Context of Public Sector research policy decisions

A first step to making useful contributions to Public Sector research policy decisions and to achieve leverage from them for the Private Sector's goals is to understand the context in which they will be used. Private Sector actors, whose world view is strongly influenced by the commercial boundaries of their own activities, may not recognize that the information or advice which they convey may be a very small

[77] See the issue 'Mutual invitations' on page 35
[78] This section has been partially inspired by Jacobs 2002.

consideration in the policy maker's "decision space[79]". New information or policy proposals may have obvious merit from a commercial perspective; however, they may not be compatible with other essential criteria in the highly complex environments of policy makers.

Step 2: Identify the recipients of Private Sector contributions and understand their perspective

The potential impact on research policy decision making depends to a large extent on objectives and agendas of the organisations or individuals that might use the provided information or advice. For example, Private Sector stakeholders should recognise early possible miscommunications, caused by a mismatch between their need for short term action and quick results and strategic long term science policy objectives, pursued by policy makers. To maximise their achievable impact, they must also understand possibly occurring barriers and influencing factors in the Public Sector's decision processes, e.g. diverging views between ministries.

Step 3: Understand the value and credibility of information or advice provided

It is important to understand how the information or advice provided will be used by the recipients and what constitutes credible information or advice. For this purpose, Private Sector actors should ask themselves: '*Does it add new insights for them, confirm or contradict their current perception? How credible are information or advice provided? How do these fit into the overall landscape of policy makers' perceptions, contributions from other stakeholders, etc.?'*

Step 4: Provide the right content and arguments in the right form at the right time

The relevance and utility of the information or advice provided and their possible impact on research policy instigation, definition and implementation depend critically on the capability to 'get the message across'. This includes for example decisions on the form of the contribution (e.g. discussion paper, letter, etc.) and on the degree of formalisation (e.g. formal letter, personal advice, etc.) and on the communication channel (e.g. high-level meeting, lobbying, informal meeting, etc.). Timing is particularly important. To make sure that the information or advice provided is useful and has the desired an impact, Private Sector actors must be aware of and responsive to the periods when specific types of research policy decisions are made.

6.4 Recommendations for the European Commission

The European Commission can support, for example under the OMC framework, the exchange of experiences and joint learning among it's the member states in order to contribute to the development of the national Public and Private Sector interfaces. To achieve an efficient Private Sector interaction in Public Sector research policy decision making, the following actions may be helpful:

- **Promote the concept of Private Sector interaction and encourage the exchange of experiences and joint learning[80]**

  The networks of national policy makers established under the CREST and OMC frameworks provide an ideal platform for disseminating insights on the value of efficient Private Sector interaction and on best practices. In an interactive exchange among practitioners, the base information provided by this report can be further extended and a process to work towards next generation practices in this area can be stimulated.

[79] The term "decision space" means the range of realistic options available to policy makers to resolve a particular problem.

[80] Including the alignment of policies developed in this field with related other OMC action areas (See CREST 2004a and CREST 2004b for details)

- **Establish a database of good practices and, where appropriate, quantitative and qualitative indicators and benchmarks**

  For the further development of their national approaches to Private Sector interaction, member states must be aware of where they stand against their peers and against the best in the world and what their possibilities for improvement are.

  One of the limitations of this study is that it provides only a qualitative information base about current approaches. As its mission was not to develop indicators for measuring the efficiency of these approaches, our study can give policy makers only a very rough feeling for their current strengths and weaknesses without a solid base for measuring achievable and achieved progress. Therefore we propose as a first step to launch an initiative to develop such indicators and benchmarks[81].

- **Work towards guiding principles for Member States, combined with possible pathways for improving Private Sector interaction**

  As each country has different specific conditions and needs, there is no such thing as a 'one fits all' solution. But joint work on this issue, stimulated and supported by the Commission, could lead to a valuable framework which provides member states with the necessary information and tools for further development of their specific approach. This might also include stimulation and support for translating these European guiding principles into national and regional policies by setting specific targets and adopting measures, taking into account national and regional differences.

- **Periodic monitoring, evaluation and peer review as a mutual learning process**

  Experience in other policy domains suggests that the European Commission can support the implementation of national measures to improve Private Sector interaction. For example, an shared diagnostic framework and a platform for neutral feedback might help the member states to assess their actual status and progress towards best practices, to gain rapidly insights into new evolving approaches and to exchange experiences made with their implementation[82].

- **Provide special support for new member and candidate countries**

  Our analysis has shown that several of the new member and candidate countries are in a particularly challenging situation because of the deep restructuring of their economies and National Science and Innovation Systems. Since they have a longer way to go than other countries with a well-established system, they merit special attention. In view of the current development stages of their systems and of the multitude of other challenges these countries face in parallel, it will be difficult for each of them to achieve the necessary progress in an isolated mode. Therefore the European Commission could support the learning and development process in these countries through special support of awareness creation, transfer of policy approaches and good practices and national initiatives.

[81] For example in the context of ERAWATCH

[82] The successful Trend Chart on Innovation initiative with its Innovation Scoreboard could serve as a model for such an overarching benchmarking and information platform. Possibly Private Sector interaction indicators could also be incorporated here?

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Appendix A2 List of figures, tables and case study/industry example insertions

Figures

Tables

Case study/industry example summary insertions

Appendix A3 Detailed Profiles of Instruments

Informal personal contact

Category:
Networking and general discussion

Description

- Ad hoc or regular contact on a personal basis to
  - discuss status and evolving issues;
  - maintain the network
  - prepare viewpoints and consensus in official meetings
- Contact based on personal relationships
- Contact can be initiated
  - ad hoc ("We call each other when an issue comes up..")
  - regular ("We meet every .. weeks to exchange our views")

Typical forms of use

- No archetype of a 'typical form', this type of communication depends on the communication culture, general relationships between both sides (friendly? Formal? Etc.) and on individuals involved
- Mutual trust is an underlying key feature ("The other side knows that we are not playing games…")

Characteristics

Initiation:	Can be initiated by both sides
Actors:	*Private Sector* - Industry association staff - Individuals (Can be linked with lobbying) *Public Sector* - Typically ministry or agency staff, policy makers
Occurrence:	Occurs in almost all countries
Use:	Most important in instigation and design stages
Applicability:	Applicable in all types of NSIS[1)] and at all levels
Success Factors:	Established personal links, mutual trust

Regular routine meetings

Category:
Networking and general discussion

Description

- "Official" regular get-together
  - quasi formal character,
    but
    no specific 'burning' issue
- Institutionalised platform for mutual information and for exchanging actual positions
- Typically on working level

Typical forms of use

Typical forms of use include bilateral or multilateral meetings of a

- **'jour fixe'** type (on a regular basis)
- **'ad hoc'** type (as needed)

Characteristics

Initiation:	Possible by both sides, more often initiated by Public Sector
Actors:	*Private Sector* - Initiation: Industry association or think tank - Participation: Individuals or representatives of institutions *Public Sector* - Initiation: Typically responsible ministry, agency, or equiv.
Occurrence:	Used in many countries
Use:	No specific stage, issues from all stages are possible discussion topics
Applicability:	All types of NSIS
Success Factors:	Mutual trust & commitment to relationship, openness and fairness

1) "NSIS" = National Science and Innovation Systems, abbreviation used throughout Appendix A3.

Appendix A3: Detailed Profiles of Instruments (continued)

Mutual invitations

Category:
Networking and general discussion

Description

- Research policy issues are usually discussed at internal meetings of policy institutions, industry associations, etc.
  - are often also of high relevance for the other side and therefore subject to subsequent informal or formal bilateral discussions in external meetings
- Inviting representatives of the other side immediately to such discussions can
  - improve the efficiency of communication; and
  - contribute to strengthening the relation and build mutual trust and understanding

Typical forms of use

Typical forms of use include
- **regular mutual invitations**, for example to internal routine meetings
- **ad hoc invitations**, when hot topics come up

Participation may be for the whole meeting, but is Usually limited to the topic of shard interest

Characteristics

Initiation:	Possible by both sides
Actors:	*Inviting party* - Identification of issues for joint discussion - Initiative (incl. invitation, location, etc.) *Invited party* - Collaboration (prepares own contributions and reports back to its institution)
Occurrence:	Used by selected pairs of Public and Private Sector institutions
Use:	Complementary instrument to enhance informal and regular communication
Applicability:	All types of NSIS
Success Factors:	Requires shared interest and commitment

Conferences

Category:
Networking and general discussion

Description

- Ad hoc or regular public events to
  - present state-of-the-art and actual views of stakeholders on issues of interest for research policy
  - express and discuss different viewpoints
  - disseminate policy concepts and opportunities (e.g. new research funding schemes).
- Often organised for example as
  - milestone event of research programmes;
  - ad hoc event on “burning issues”

Typical forms of use

Typical forms of use include
- **status discussions** to report on progress of large research programmes and to obtain feedback;
- **policy debates** to discuss actual research policy issues and to provide a platform for networking

Characteristics

Initiation:	Possible by both sides, more often initiated by Public Sector
Actors:	*Private Sector* - Initiation: Industry association or think tank - Participation: Individuals or representatives of institutions *Public Sector* - Initiates (typically responsible ministry, agency, or equiv.)
Occurrence:	Used in many countries
Use:	Complementary instrument to reach a broad audience (all stages)
Applicability:	All types of NSIS
Success Factors:	Attract target audience convincing “messages”

Appendix A3: Detailed Profiles of Instruments (continued)

Discussion platforms

Category:
Networking and general discussion

Description

- Dedicated framework for encounter
  - 'open space' for free discussion, testing of new ideas and joint learning
  - usually among high-level decision makers
  - seek and discuss new solutions, invite 'out-of-the-box' thinkers, etc.
- Typically 'semi-institutionalised'
  - initiating party provides space and takes initiative to organise meetings
  - often regular meetings

Typical forms of use

Typical forms of use include
- **discussion circles**, usually with participation limited to a smaller number of key individuals

Characteristics

Initiation: Possible by both sides, more often initiated by Private Sector

Actors:
Private Sector
- Initiation: Industry association or think tank
- Participation: Top level Individuals

Public Sector
- (Co-)Initiation: high-level politician, ministry or agency

Occurrence: Used in some countries

Use: Complementary instrument to foster & exploit high-level networks

Applicability: All types of NSIS

Success Factors: Exclusive networks
Dedication of participants

(Thematic) Networks and communities

Category:
Networking and general discussion

Description

- 'Communities of interest' gathering around a specific thematic area
  - shared interest in specific research topic, sector, etc.
  - typically participants from operative level (peers)
- Helpful to
  - bring together operative actors in a problem-solving mode
  - involve stakeholders which otherwise are difficult to reach (e.g. SMEs)

Typical forms of use

Typical forms of use include
- **Public Sector-initiated and sponsored networks** (e.g. thematic communities in a specific research area, regional communities in clusters)
- communities that form **spontaneously** upon initiative of the actors

Characteristics

Initiation: Possible by both sides, more often initiated by Public Sector

Actors:
Private Sector
- Initiation: Industry or sector association
- Participation: Individuals or representatives of institutions

Public Sector
- Initiation: Typically ministry or agency

Occurrence: Used in several countries

Use: Complementary instrument to involve stakeholders in specific thematic area

Applicability: All types of NSIS

Success Factors: Gain commitment
Moderation

Appendix A3: Detailed Profiles of Instruments (continued)

Staff mobility and knowledge transfer

Category:
Networking and general discussion

Description

- Temporary or long-term engagement of staff from the complementary sector to
  - extend and intensify personal and institutional networks
  - develop better mutual understanding
  - acquire complementary competencies and skills
- Different determinants:
  - degree of formalisation (e.g. visiting engagement ↔ staff exchange ↔ …)
  - level (institutional, personal)
  - motivation (intrinsic ↔ formal incentives)

Typical forms of use

Typical forms of use include
- **visiting professorships**
- **staff exchange** programmes between ministries/ agencies and Private Sector institutions
- Position moves between both sides as part of **personal career paths**
- Hiring of executives with industry background into public research **board and directors' positions**

Characteristics

Initiation:	Possible by both sides Formal programmes in mutual agreement Individuals involved (career decisions)
Actors:	*Private Sector* - Associat./companies - Individuals *Public Sector* - Institutions - Individuals
Occurrence:	Used selectively in specific countries
Use:	Support of network formation
Applicability:	All types of NSIS; depen-dent on national context
Success Factors:	Favourable environment Initiative by individual and institution

Published information

Category:
Networking and general discussion

Description

- Regular information about research policy perceptions, issues and proposals
- Typical form: Newsletter, Internet presence
- Used to
  - inform a broad audience about own perceptions
  - communicate ideas and needs to a broad audience
  - create a public discussion forum
  - mobilise a broader audience

Typical forms of use

Typical forms of use include
- **newsletters**, for example accompanying major research programmes or institutions
- **Internet presentations**
- **press information and events**

Characteristics

Initiation:	Typically initiated by Public Sector (occasio-nally also Private Sector)
Actors:	*Issuing institution* - Publication
Occurrence:	Used in most countries
Use:	Create general aware-ness, information of broad audience (alls stages)
Applicability:	Applicable in all types of NSIS Not suitable for in depth discussion, but can create "entry points" for interested readers
Success Factors:	Attractive contents and form; target audience and media properly identified

Appendix A3: Detailed Profiles of Instruments (continued)

Awareness campaigns

Category:
Awareness, commitment and influence

Description

- Dedicated approach to reach specific target groups in order to get them interested and involved in policy initiatives
- Often used to broaden participant base and to involve target groups
- Trend: "Closer to the customer" (From central events to local events)

Typical forms of use

Typical forms of use include
- **information days**
- **"road shows"**, for example to inform SME's about new research funding schemes
- **seminars** (for example centrally coordinated, organised by local support institutions, e.g. technology centres)

Characteristics

Initiation: Typically initiated by policy makers

Actors: *Public Sector*
- Initiation: Typ. ministry
- Preparation of materials: Agency
- Participant acquisition, local delivery: Local institutions

Occurrence: Used in several countries

Use: Create awareness among less involved target groups (Instigation, implementation)

Applicability: All types of NSIS

Success Factors: Convincing message to attract target audience

Foresight exercises

Category:
Awareness, commitment and influence

Description

- Broadly based initiatives to
  - identify and assess potential research areas, technology trends, etc.
  - obtain feedback from a broad audience of stakeholders and experts
  - direct the stakeholder attention to research policy priority issues and gain their commitment
- Objectives may be extended to a mobilisation of policy makers and stakeholders to initiate reforms
- Typically organised as highly interactive exercise, involving all stakeholders

Typical forms of use

Typical forms of use include
- **large, nationwide exercises**, organised by national governments and involving a broad audience and top level stakeholder representatives
- **targeted foresight exercises**, for example to mobilise specific sectors

Characteristics

Initiation: Typically by Public Sector (occas. Priv. Sector)

Actors: *Public Sector*
- Initiation: Policy maker
- Organisation & moderation: Agencies or ad-hoc working groups

Private Sector
- Participation (Expert/ stakeholder role): Individuals, association representatives)

Occurrence: Growing number of countries

Use: Mostly in instigation and design phase

Applicability: All types of NSIS

Success Factors: Commitment of key stakeholders, interactive process moderation, methodology

Appendix A3: Detailed Profiles of Instruments (continued)

Ad hoc meetings and workshops

Category:
Awareness, commitment and influence

Description

- Often used by policy makers for
  - identification and assessment of emerging research areas and policy needs
  - 'low level' testing of emerging ideas about new research or policy areas
- Typically a limited one time effort
- Results used by policy makers to define follow up if appropriate
- Also usable as first step to ignite a more intense discussion about perceived priority issues (Often supported by study to create reliable data base)

Typical forms of use

Typical forms of use include
- **expert meetings** to invite experts' opinion about research issues, new innovative research concepts, etc.
- **workshops** with stakeholder participation, where situation, challenges and options are discussed

Characteristics

Initiation: Usually by Public Sector

Actors: *Public Sector*
- Initiation: Identifies topic & invites

Private Sector
- Participation (in an expert role)

Occurrence: Selected countries

Use: Complementary instrument to gain additional insights, especially on emerging issues

Applicability: All types of NSIS

Success Factors: Choice of topic
Selection of participants
moderation and use of results

Ad hoc studies

Category:
Awareness, commitment and influence

Description

- Ad hoc in depth investigation to
  - create insights into potentially important policy areas and a rational data basis for discussion
  - raise the important issues and develop first positions
  - create or enhance awareness to put the topic on research policy agendas
- Usually
  - commissioned by stakeholders or policy makers
  - carried out by experts or consultants

Typical forms of use

Typical forms of use include
- **expert studies**, for identification and evaluation of technologies, research areas, etc.
- **research policy-related studies**

Characteristics

Initiation: By both sides (Occasionally also other stakeholders, e.g. NGO's)

Actors: *Private Sector or Public Sector*
- Initiation (of study)
- Dissemination (of results)

Study performer (e.g. Consultant)

Occurrence: Used in many countries

Use: Instigation/design stage (but occasionally also implementation or review stages)

Applicability: Applicable in all types of NSIS

Success Factors: Study design and quality
Communication of results

Appendix A3: Detailed Profiles of Instruments (continued)

Position papers

Category:
Awareness, commitment and influence

Description

- Prepared by one of the stakeholders to express a dedicated view on a priority research policy issue
- Used to launch and/or influence an ongoing policy discussion
- Often disseminated broadly (including press, etc.)

Typical forms of use

Typical forms of use include
- **"white papers"**
- **(formal) memorandum**

Characteristics

Initiation: By any stakeholder (typically Private Sector, but also research community, NGO's, etc.)

Actors: *Private Sector (or other)*
- Preparation of position paper
- Dissemination, initiation of discussion

Public Sector
- Typically recipient

Occurrence: Frequently used in various countries

Use: Typically in instigation phase

Applicability: Applicable in all types of NSIS

Success Factors: Line of arguments
Efficient communication

Public statements

Category:
Awareness, commitment and influence

Description

- Dissemination of stakeholder viewpoint using public media
- More indirect form of positioning stakeholder view
  - create broad awareness
  - mobilise public opinion
- But may also be of a defensive nature (e.g. to counter negative image or previous statements from other stakeholders)

Typical forms of use

Typical forms of use include
- **press conferences**
- **articles**
- **Internet**
- etc.

Characteristics

Initiation: Typically initiated by Private Sector (association or company)
But may also be used by policy makers, etc.

Actors: *Private Sector*
- Usually the initiator (occasionally also Public Sector actor)

Occurrence: Frequently used in most countries

Use: In all phases

Applicability: All types of NSIS

Success Factors: Convincing line of arguments,
efficient communication,
fairness (otherwise counterproductive for cooperative interaction)

Appendix A3: Detailed Profiles of Instruments (continued)

Lobbying

Category:
Awareness, commitment and influence

Description

- Individuals or organisations specialising in policy relations as intermediates to
  - get access to key decision makers
  - position opinions and proposals
  - influence decision processes and their outcome
- Takes often place in a broader lobbying context (Often lobbyists cover a broader range of issues, beyond research and innovation policy)

Typical forms of use

Typical forms of use include

- **specialised corporate departments** for research policy and related issues (usually only in larger companies)
- part of the duties of **industry or sector associations**
- specialised **lobbyists**

Characteristics

Initiation:	Private Sector
Actors:	*Private Sector* - Preparation and communication of policy messages: Individual companies - Consolidated representation of Private Sector needs) *Public Sector* - 'Recipient'
Occurrence:	In all countries
Use:	Standard instrument to communicate with policy makers
Applicability:	All types of NSIS
Success Factors:	Choice of lobbyist Adequate messages

Appendix A3: Detailed Profiles of Instruments (continued)

Ad hoc consultations

Category: Advice

Description

- Ad-hoc consultation with Private Sector and other stakeholder experts to obtain expert view and/or stakeholder statement on important actual issues
- Can take place at different levels, e.g.
  - Personal advice for high-level decision makers
  - One-time advice for ministries in charge of evaluating the necessity to instigate new policies
  - One-time advice for agencies in charge of refining policy implementation measures

Typical forms of use

Typical forms of use include
- **Ad-hoc workshops** (typically upon invitation by the ministry in charge)
- **Personal consultations**

Characteristics

Initiation: Possible by both sides, typically by Public Sector

Actors: *Private Sector*
- Formal expert participation
- Personal consultation

Public Sector
- Organisation of ad-hoc workshops by ministries
- Personal invitation

Occurrence: Used in various countries

Use: Mostly in instigation or design phase

Applicability: Applicable in all types of NSIS

Success Factors: Identification of consultation opportunities, open, constructive dialogue

Continuous consultative role

Category: Advice

Description

- Established, regular exchange with Private Sector and other stakeholder experts to exchange on research policy issues and to build/maintain relationship and trust
- Can take place at different levels, e.g.
  - in parliamentary hearings in preparation of research policy guidelines
  - at ministerial level, for example to prepare policy measures
  - At the operative level

Typical forms of use

Typical forms of use include
- **expert hearings or testimonies** (e.g. parliament working group expert hearings)
- **formal meetings**
- **Informal meetings** (e.g. mutual invitations)

Characteristics

Initiation: Possible by both sides, more frequent by Public Sector

Actors: *Private Sector*
- active participation
- willingness to exchange openly

Public Sector
- active participation
- willingness to exchange openly

Occurrence: Used in various countries

Use: Mostly in instigation or design phase, but can cover all phases

Applicability: Applicable in all types of NSIS

Success Factors: Mutual trust openness and commitment

Appendix A3: Detailed Profiles of Instruments (continued)

Internet consultations

Category: Advice

Description

- Invitation to a broad audience to express views on specific policy issue in an Internet-based survey
- Based on the Internet
  - easy Access
  - high transparency
  - heterogeneous responses
- Typically complementary element of a more comprehensive policy formulation exercise (e.g test of draft policy concepts)

Typical forms of use

Typical form of use is a **questionnaire published on the Internet** which can be filled out and returned by any interested party

Characteristics

Initiation: Initiated by Public Sector

Actors:
Private Sector
- Participation: Through statements of associations, companies and individuals

Public Sector
- Initiation: Policy makers
- Execution: Agencies

Occurrence: Selected countries

Use: Instigation or design phase

Applicability: Applicable in all type of NSIS (if Internet communication = established communication form)

Success Factors: Design of questionnaire, balanced sample of participants

Expertise

Category: Advice

Description

- Market/technology experts from the Private Sector consulted in policy formulation
  - selective input on specific aspects of research policy definition in an expert role
  - advice integrated in overall policy formulation process
- Pure expert role, not involved in formulation of conclusions and resulting policies

Typical forms of use

Typical forms of use include
- **expert testimonies**
- **written expert report**

Characteristics

Initiation: Initiated by Public Sector

Actors:
Public Sector
- Selection and invitation of experts
- Integration of expertise in policy formulation process

Private Sector
- Provision of experts

Occurrence: Used in selected countries

Use: Instigation and design phase

Applicability: Applicable in all types of NSIS

Success Factors: Expert selection
Efficient integration of expert opinions

Appendix A3: Detailed Profiles of Instruments (continued)

Ad hoc advisory groups

Category: Advice

Description

- Non-permanent advisory group assembled to advise research policy makers ad hoc on 'burning issues'
  - organized on an "as needed" base"
  - typically involving experts and/or high-level representatives from all stakeholders

Typical forms of use

Typical forms of use include
- **'one time'** expert advisory meetings
- **ad hoc advisory groups** with a limited duration (Several meetings for analysis and preparation of recommendations, dissolved after delivery of final report)

Characteristics

Initiation:	Initiated by Public Sector
Actors:	*Public Sector* - Initiation: Ministry or agency - Participant selection, organisation & documentation of results: Agency *Private Sector* - Participation (Individual or delegated by association)
Occurrence:	Used in various countries
Use:	Design phase
Applicability:	Applicable in all types of NSIS
Success Factors:	Expert selection Workshop moderation

Individual advisory role

Category: Advice

Description

- Personal advice on a peer-to-peer basis, typically on a high decision maker level
- Provided on an individual basis
  - direct access to decision maker on a peer level
  - often more of a coaching or nature
  - can be completely informal on a personal base or formally/institutionalised
  - advice based on personal credibility
- Typically provided on the basis of an intensive personal relationship

Typical forms of use

Typically forms of use include
- **advisory type discussions** between individuals
- **High-level roundtable discussions** on a peer-to-peer basis

Characteristics

Initiation:	Typically initiated by high-level policy decision maker
Actors:	*Public Sector* - Initiation: Policy maker, ministry or agency *Private Sector* - Participation: high-level individual (e.g. Senior corporate executive)
Occurrence:	Used in selected situations
Use:	Selective use by policy makers (Focus on instigation & design)
Applicability:	All types of NSIS
Success Factors:	Choice and commitment of advisors, positioning in overall policy making context

Appendix A3: Detailed Profiles of Instruments (continued)

Advisory committee

Category: Advice

Description

- Institutionalised group to provide formal advice to policy makers
  - typically composed of high-level representatives of stakeholders (Strong Private Sector representation)
  - explicitly formulated tasks and rights (in some countries even defined by law)
  - in most cases operative support ensured (e.g. by dedicated support structure)
- Current in most NSIS, but form and intensity vary, depending on overall research and general policy governance context

Typical forms of use

Typical forms of use include
- **unempowered advisory role** (i.e. no obligations for policy makers caused by advice provided)
- **empowered advisory role** (i.e. advisory group has defined rights and policy makers obliged to react)

Characteristics

Initiation: Initiated by public Sector

Actors:
Public Sector
- Initiation, moderation & documentation of results: Ministry or agency
- Provision of support: In selected cases own infrastructure funded

Private Sector
- Participation: Expert provision

Occurrence: Used in many countries

Use: Policy instigation and formulation

Applicability: Applicable in all types of NSIS

Success Factors: Expert selection, definition & institutionalisation of duties and rights

Unsolicited advice

Category: Advice

Description

- Extended form of advice: Expertise linked to direct policy advice
  - strong means to promote preferred solutions
  - used if formal advice not solicited
- 'Reversed procedure':
  - Private Sector takes initiative and drafts own policy (elements) and submits to policy makers
  - policy makers consider and integrate – if appropriate – in own policy formulation processes

Typical forms of use

Typical forms of use include
- **written communication** (e.g. policy proposal)
- **personal communication** (e.g. via top level contacts)

Characteristics

Initiation: Private Sector

Actors:
Private Sector
- Identification of policy issues: Association, group or individual
- Preparation and communication of advice

Public Sector
- Recipient of (unsolicited) advice

Occurrence: Occasionally used

Use: If solicited advice and communication not existent or invited

Applicability: All types of NSIS

Success Factors: Appropriateness of advice, communication

Appendix A3: Detailed Profiles of Instruments (continued)

'Think tanks'

Category:
Advice

Description

- Independent organisations focussing on
  - creation of innovative policy solutions
  - participation in policy debates
  - provision of independent advice
- Dedicated organisations
  - own organisation with a strong policy competency base
  - reliable long-term budget
- Successful leading-edge examples of Private Sector funded 'think tanks' in selected countries

Typical forms of use

Typical forms of use include independent organisations

- **with Public Sector or mixed funding**
- **funded by the Private Sector**
- **with independent funding** (e.g. charitable foundation)

Characteristics

Initiation:	Can be initiated by both sides
Actors:	*Initiator* - Definition of role and tasks of "think tank" - Financing *Think tank staff* - Independent experts
Occurrence:	In selected countries, different forms of financing
Use:	Focus on instigation and definition phases
Applicability:	Applicable in all types of NSIS
Success Factors:	Independence, recognized competency, high quality work

Appendix A3: Detailed Profiles of Instruments (continued)

Impact assessment

Category: Policy (co-) design, decision making & implementation

Description

- Efficient means to verify the expected appropriateness and validity of planned research policy measures from a Private Sector perspective
- Interactive (often also iterative) process
  - draft policy formulated
  - expected impact analysed by Private Sector
  - results used to refine policy draft
- Used successfully in selected countries
- Requires a highly collaborative and open working mode

Typical forms of use

Typical forms of use include

- **invited impact assessment** upon request of policy makers when drafting research policy
- **unsolicited impact assessment** as a reaction of the Private Sector to research policy proposals

Characteristics

Initiation: Can be initiated by both sides

Actors:
Private Sector
- Provision of necessary expertise (to assess policies formulated by policy makers)

Public Sector
- Provision of draft policies
- Initiation of impact assessment

Occurrence: Used in selected countries

Use: Policy definition

Applicability: Applicable in all types of NSIS

Success Factors: Methodology, open working mode, 'no games'

Steering Committees

Category: Policy (co-) design, decision making & implementation

Description

- Institutionalised group accompanying major research programmes or equivalent
  - provides formal advice to programme management (in some cases with co-decision function)
  - composed of high-level stakeholder representatives (typically strong Private Sector participation)
  - Institutionalised, part of programme structure

Typical forms of use

Typical forms of use include the following roles:

- **preparing and proposing decisions** (which are ultimately taken by policy makers)
- own **co-decision function** for operative questions and/or strategic directions, etc.

Characteristics

Initiation: Initiated by public Sector

Actors:
Public Sector
- Initiation of committee: Ministry or equivalent
- Organisation, moderation and documentation: Ministry or agency staff

Private Sector
- Participation: high-level individuals

Occurrence: Used in many countries

Use: Policy implementation

Applicability: Applicable in al types of NSIS

Success Factors: Participant selection, definition of role, efficient programme decision processes

Appendix A3: Detailed Profiles of Instruments (continued)

Evaluations

Category: Policy (co-) design, decision making & implementation

Description

- Standard tool in many countries to assess appropriateness and efficiency of research policy measure
- Important role in the assessment of follow-up policy need and its design
- Private Sector interaction beneficial for both sides
  - feedback on actual/past programme performance
  - future policy need from Private Sector perspective

Typical forms of use

Typical forms of use include

- **ex-post evaluations**
- **ex-ante evaluations**

Characteristics

Initiation: Public Sector

Actors:
Public Sector
- Identification of need for evaluation: Policy makers
- Execution of evaluation: Independent expert or consultant
- Integration of results: Policy makers

Private Sector
- Inputs: As respondents, interviewees, etc.
- Comments: As steering group member

Occurrence: Frequent, most countries

Use: Focus: implementation

Applicability: All types of NSIS

Success Factors: Independent evaluation, efficient use of results

Board memberships

Category: Policy (co-) design, decision making & implementation

Description

- Integrate Private Sector representatives in board positions of policy making or of scientific institutions
  - make Private Sector knowledge and experience accessible
  - strengthen the links with the Private Sector

Typical forms of use

Typical forms of use include

- **advisory** boards (for example scientific advisory role)
- **supervisory** boards (approves strategies and important decisions)
- **management** boards

Characteristics

Initiation: Typically initiated by the public institution

Actors:
Private Sector
- Board membership: Individual (typically senior executive)

Public Sector
- Invitation and appointment: Institution

Occurrence: Used by selected institutions in various countries

Use: Implementation (Support or supervisory role)

Applicability: Applicable in all types of NSIS

Success Factors: Selection of board members, integration of Private Sector members in boards

Appendix A3: Detailed Profiles of Instruments (continued)

Policy task forces

Category: Policy (co-) design, decision making & implementation

Description

- Task forces with participation of policy maker and stakeholder representatives empowered to draft policies on behalf of government
- Efficient means to assemble expertise, create shared vision and gain 'buy in' from stakeholders
- Delegation can raise control issue

Typical forms of use

- Typical form of use is a **temporary task force** established to formulate a specific research policy
- **Extended duration or institutionalisation** possible if appropriate

Characteristics

Initiation: Initiated by Public Sector

Actors:
Public Sector (typically ministry)
- Initiation : Ministry
- Development of results: Joint task force
- Decision on results: Ministry

Private Sector
- Peer level participation

Occurrence: Used in selected countries

Use: Policy design (often for specific sectors)

Applicability: Applicable in all types of NSIS

Success Factors: Composition of task force, empowerment, consequent implementation of recommendations

Innovation Platforms

Category: Policy (co-) design, decision making & implementation

Description

- Established with the objective to strengthen the link between concept formulation and implementation
  - come up with innovative policy concepts
  - generate innovative ideas
  - secure their efficient and pragmatic implementation
- For this purpose, Innovation Platforms
  - have high-level members who can act as spokesmen of their stakeholder groups and make implementation commitments
  - have a decision- and implementation-oriented mode of operation

Typical forms of use

Typical forms of use include innovation platforms which are geared towards

- **integrated policies** (linking Public Sector policies with Private Sector strategies in joint activities)
- **'lighthouse' projects** (which the participating organisations can initiate themselves)

Characteristics

Initiation: Initiated by Public Sector

Actors:
Public Sector
- Initiation and empowerment: High-level policy maker

Private Sector
- Participation: Individuals or companies

Innovation Platform
- Development and launch of initiatives

Occurrence: Used in selected countries

Use: Integrated design and implementation

Applicability: Applicable in all types of NSIS

Success Factors: Group composition, commitment of members and government

Appendix A3: Detailed Profiles of Instruments (continued)

Joint (operative) decision making

Category: Policy (co-) design, decision making & implementation

Description

- Regional or cluster research policies are typically defined and implemented jointly by the Public and Private Sector actors
- This includes a close interaction, shared policy definition, co-financing and co-execution of research activities replaces to some extent individual decision making by the involved Public and Private Sector actors
- Formation and development of such clusters (and thus joint decision making) can be stimulated by policy measures on national level

Typical forms of use

Typical forms of use include

- **measures to stimulate formation and development of clusters** (Typically by national policy makers)
- cluster internal **operative decision making** (by the cluster actors)

Characteristics

Initiation:	Typically initiated by national policy makers or regional actors
Actors:	*Public Sector* - Stimulation of cluster formation: Ministry *Operative actors (both public and private)* - Design and implementation (incl. co-decision, co-execution)
Occurrence:	Used in different forms in various countries
Use:	Integrated from instigation to implementation on regional level
Applicability:	Applicable in all types of NSIS
Success Factors:	Commitment of local actors, critical mass, efficient local organisation

Delegated implementation

Category: Policy (co-) design, decision making & implementation

Description

- Policy measure designed and funded by policy maker
  but
  implementation delegated to private institution
- Delegated tasks may include for example
  - management of budget and of project portfolio of research funding programmes
  - funding decisions for project proposals (in combination with an approval or veto right of the delegating institution)
  - project milestone decisions)

Typical forms of use

A typical form of use is the **management of an applied research fund** by a private financial enterprise on behalf of the responsible ministry

Characteristics

Initiation:	Initiated by policy maker
Actors:	*Public Sector* - Policy definition and delegation of implementation: Ministry *Private Sector* - Execution (e.g. operative management of research funding programme: "Service provider"
Occurrence:	Used in selected cases
Use:	Implementation stage
Applicability:	Depending on willingness of policy maker to delegate, legal framework, etc.
Success Factors:	Consequent delegation, transparent interfaces, efficient execution

Appendix A3: Detailed Profiles of Instruments (continued)

Operative support

Category: Policy (co-) design, decision making & implementation

Description

- To achieve the desired leverage at the interface between Public Sector research and Private Sector R&D, certain processes or target groups need specific support (e.g. technology transfer to SMEs)
- For this purpose, policy makers have established specific support instruments or institutions
- Their efficient operation and leverage depends on a high degree of Private Sector interaction beyond being a user of their services

Typical forms of use

Typical forms of use include
- technology support programmes
- technology transfer programmes and support organisations
- regional technology centres
- model contracts

Characteristics

Initiation: Typically initiated by Private Sector (possibly in reaction to Private Sector requests)

Actors:
Public Sector
- Initiation and funding: Ministry
- Hosting and lead role: Local agency

Private Sector
- Support: Local industry
- Use of services: Industry, SMEs

Occurrence: Used in different forms in several countries

Use: implementation on operative level

Applicability: Applicable in all types of NSIS

Success Factors: Clear mission, acceptance

Private Sector research funding

Category: Policy (co-) design, decision making & implementation

Description

- Private Sector enterprises fund research in a variety of ways, e.g.
  - funding of individual projects
  - collaborative research
  - shared/embedded laboratories
- This funding influences the research policies or strategies of research institutions

Typical forms of use

Typical forms of use include
- **traditional mechanisms** (e.g. research contracts, PhD grants, etc.)
- **innovative approaches**, e.g.
  - Private Sector funding of basic research with arrangement to share results
  - co-funding of joint research projects and/or shared research facilities (incl. embedded labs, etc.)

Characteristics

Initiation: Usually Private Sector

Actors:
Private Sector
- Provision of funds, collaborative research: Individual companies

Public Sector
- (Co-)funding of collab. projects: Ministry
- Research infrastructure provision: Research institution

Occurrence: Used in most countries (depending on Private Sector needs and potential of Public Sector research)

Use: Implementation

Applicability: Applicable in all types of NSIS (?)

Success Factors: Shared objectives, clear task allocation

Appendix A3: Detailed Profiles of Instruments (continued)

Charitable foundations

Category: Policy (co-) design, decision making & implementation

Description

- In some countries, privately funded charitable foundations act as significant sources of funds for research
  - defining their research priorities
  - selecting projects to finance
  - having the opportunity to fund research beyond usual criteria (e.g. orphan drugs)
- In addition, some foundations also take a role as 'think tanks', financing policy studies and forwarding own policy concepts

Typical forms of use

Typical forms of use include

- **funding of research** by foundations
- **funding of activities stimulating research and research policies** (e.g. competitions, events)
- **funding of 'think tank' activities**

Characteristics

Initiation:	Usually Private Sector
Actors:	*Private Sector* - Initiation of foundation, funding, definition of objectives: Benevolent company or individual - Funding: Foundation
Occurrence:	Used in selected countries
Use:	Depending on foundation's approach, e.g. integrated, own policy formulation and implementation (through funding)
Applicability:	Applicable in NIS with relevant foundations
Success Factors:	Foundation's dedication to research policy, positioning vis-à-vis Public Sector research funding

Appendix A4 Background paper on the role of Private Sector interaction in research governance frameworks

A4.1 Governance of Public Sector-funded Research

According to a recent OECD report, science systems have moved in the 1990s from their traditional focus on ensuring sustained funding for research towards a broader perspective of their efficient governance. Related to this shift of paradigms, many countries have undertaken a range of reforms with the aim to better co-ordinate research within governments, to enhance the use of strategic planning and monitoring, to grant research institutions a higher degree of autonomy and to create or strengthen formal structures and mechanisms for stakeholder participation in research policy making (OECD 2003).

A key element of this transition is the necessity to respond to a broader range of stakeholders (see Figure 26). Research policy makers in governments emphasise increasingly a greater 'return' on their research investment and the resulting sustained national knowledge production in terms of tangible benefits for society and spill-over effects in the economic sector. In reaction to this, the Public Sector scientific community has also extended its traditional stake of securing appropriate funding to creating such benefits while preserving the degree of autonomy deemed necessary to pursue its research agenda and to act as a continuous source of highly skilled human resources. The Private Sector's interest in Public Sector research has grown continuously under the pressure of ever faster innovation cycles and of global markets. This has given rise to more intensive and diversified linkages between Public and Private Sector research activities. In a similar way, civil society's growing demand for new solutions for urgent problems, e.g. in the health, environment or energy areas, also creates new expectations and pressures on the research system.

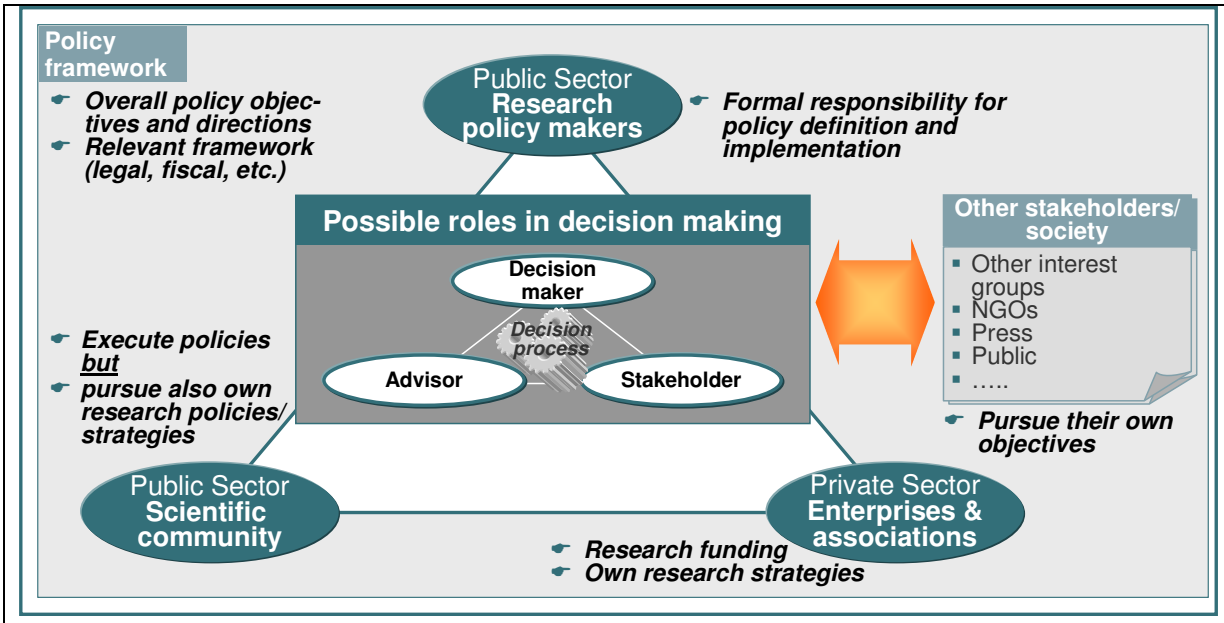

Figure 26: Stakeholder model of Private Sector interaction

The OECD study emphasises the challenge to exploit emerging opportunities more efficiently in such systems through the shift from isolated scientific disciplines to more responsive multidisciplinary and institutional networking and the need to ensure the long term sustainability of the research system. This encompasses the maintenance of a broad and diversified research portfolio and a strong resilience to 'external shocks':

> *The increase in the share of financial resources coming from the business sector or that are earmarked for co-operation with the business sector entails greater vulnerability of the science system to the business cycle and to sudden changes in business*

strategies. This can significantly affect levels of business funding for public research, as firms reduce their budget for externally performed research, shift areas of research emphasis and relocate R&D capacity on a global scale. Long-term trends in overall funding of the science system will be similarly affected and core capabilities will risk being eroded unless compensated by government funding. When the cost of re-building the capacity that would be lost exceeds that of maintaining it though a down-turn, there is a strong case for sustained government commitment to R&D support (e.g. a targeted, transitory increase in government R&D funding) and for other actions that will preserve or redirect capabilities with long-term importance.

Obviously, these different objectives can create considerable tension between the Public and the Private Sector with an important impact on their behaviour in research policy decision making.

According to this study, another important prerequisite for a healthy and adaptive science system is mutual trust among all stakeholders and a sustained fair distribution of the benefits accruing to the actors of the science system in the context of evolving relationships among them. This requires strong frameworks to guard against potential conflicts of interest, to promote ethical conduct and to create incentive structures for the extension of knowledge. An important challenge for Public Sector research funding and performing institutions is created by the fact that the potential economic benefits of public research vary considerably across research fields and academic disciplines. Obviously, in such questions the Private Sector will act as a stakeholder, promoting research with a direct benefit for him. Research policy makers however will need to find the right balance between maintaining a strong science base as a whole and creating incentives for creation and transfer of research results with economic potential and for Public-Private-Partnerships.

In parallel, a systemic perspective developed in the 1990s under the notion of 'National Innovation Systems' (NIS). This has extended the narrow view of isolated individual policy domains and explored the multitude of interactive links which research policy has with other relevant policy domains, in particular innovation and technology policy[83]. To promote innovative, flexible adaptations of their economies, governments have put increasing emphasis on developing the necessary institutional set-ups, procedures and practices for setting and implementing innovation policy agendas. Figure 27 depicts such a standard NIS model.

The tensions occurring in such systems can also have a major impact on research policy making. Among those identified by a recent OECD report, the following are of special importance (see OECD 2005 for details):

- *Competing rationales* of individual policy domains (e.g. research and industrial policy) have their own objectives and approaches, driven by communities with specific preferences, ideologies and educational backgrounds. This can lead to conflicting objectives between research policy and other policy areas and can limit the possibility for constructive solution of such issues.
- *Distinct imperatives* govern different policy domains. As a result, conflicts may arise between research policy (governed by long-term science-oriented goals), innovation policy (which typically obeys an economic growth imperative) and other policy domains (e.g. environmental/sustainability policy, linked to ecosystem perspectives).
- *Fragmentation* and *perceived division of labour between policy domains and ministries* create additional complexity. If different ministries have distinct rationales and diverging views of research and innovation policy and if responsibility and decision making power is distributed among them, efficient Private Sector interaction becomes much more difficult.

[83] Other intersections or overlaps include for example policy areas like fiscal policy (tax incentives for research) and legal (e.g. Intellectual Property regulations).

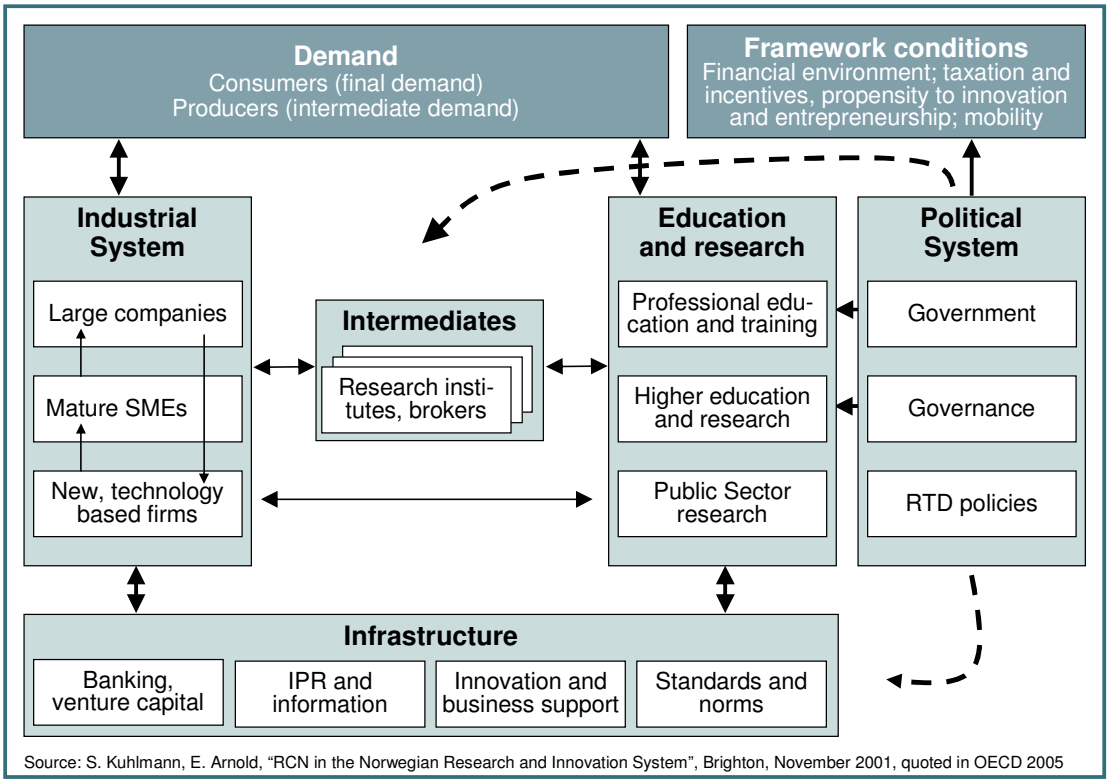

Figure 27: Generic National Innovation System

- *Short-termism* in budgetary practices can undermine strategic long-term research policy approaches which do not have an obvious short term (economic) benefit.

In view of these challenges, the OECD study recommends to develop pragmatic Public-Private Sector interfaces.

Over the years, the interface between the Public and the Private Sector has shifted from strong interventions by the state (up until the early 1980s) to much weaker ones under new public management. While sound macroeconomic policies and framework conditions are a must in modern innovation policy, there is a great potential for more pragmatic interfaces. These could include balanced stakeholder mechanisms as well as cluster policies that offer a greater potential for bundling efforts and capabilities. Effective interfaces are needed to leverage longer-term priorities and manage transitions in structures and infrastructures.

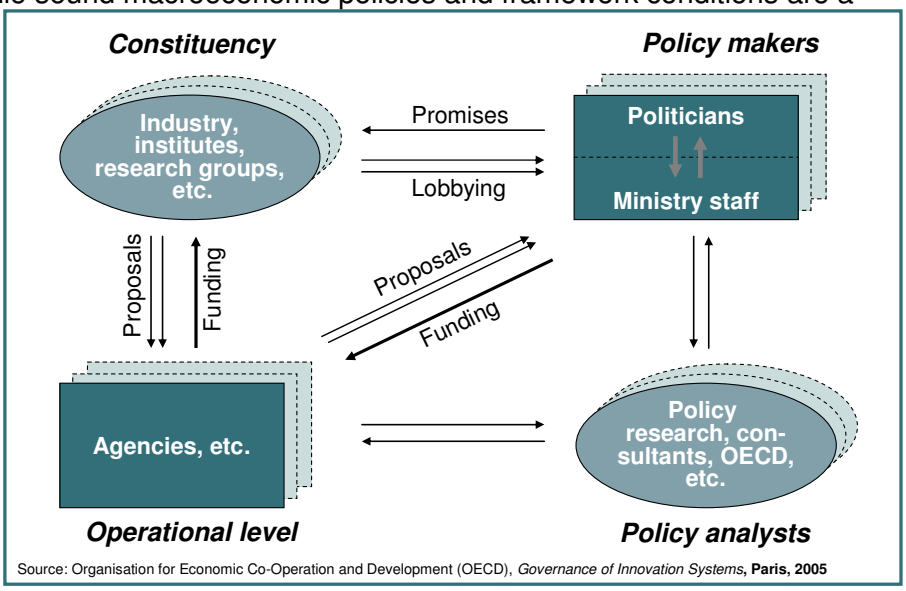

Figure 28: A dynamic model of policy making

As a result, current innovation policy making (and to a certain extent also research policy making) can be considered as a dynamic process (see Figure 28).

A4.2 Research policy decision processes

Ideally, research policy decision making follows the generic path depicted in Figure 29:

- In a first step, research policies are *instigated* on the basis of perceived needs. Priorities must be set to account for limited resources available for such research policies and objectives must be defined for priority areas.
- Based on these overarching priorities, detailed policies are formulated in the following *design* stage. This includes necessary decisions on the allocation of available funds, the choice of policy approaches and instruments for selected target areas, the definition of target groups, etc.
- During the *implementation* of research policies, most decisions address operative issues, e.g. funding decisions for proposed projects.

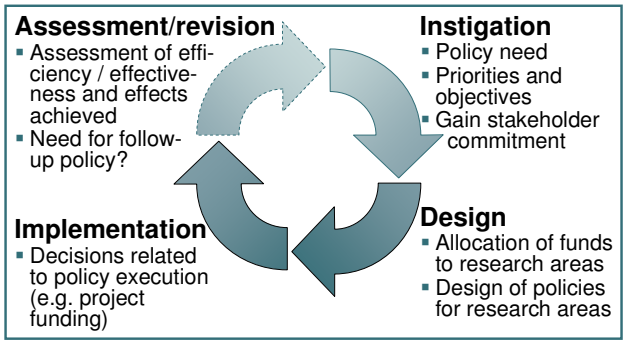

Figure 29: Generic research policy cycle

- Ideally, the concluding *assessment* of research policies reveals their strengths, weaknesses, achievements and results in a revision of the research policy, thus forming at the same time the basis for a necessary *revision* (e.g. the instigation of a next-generation research policy).

Figure 30 describes this process in more detail.

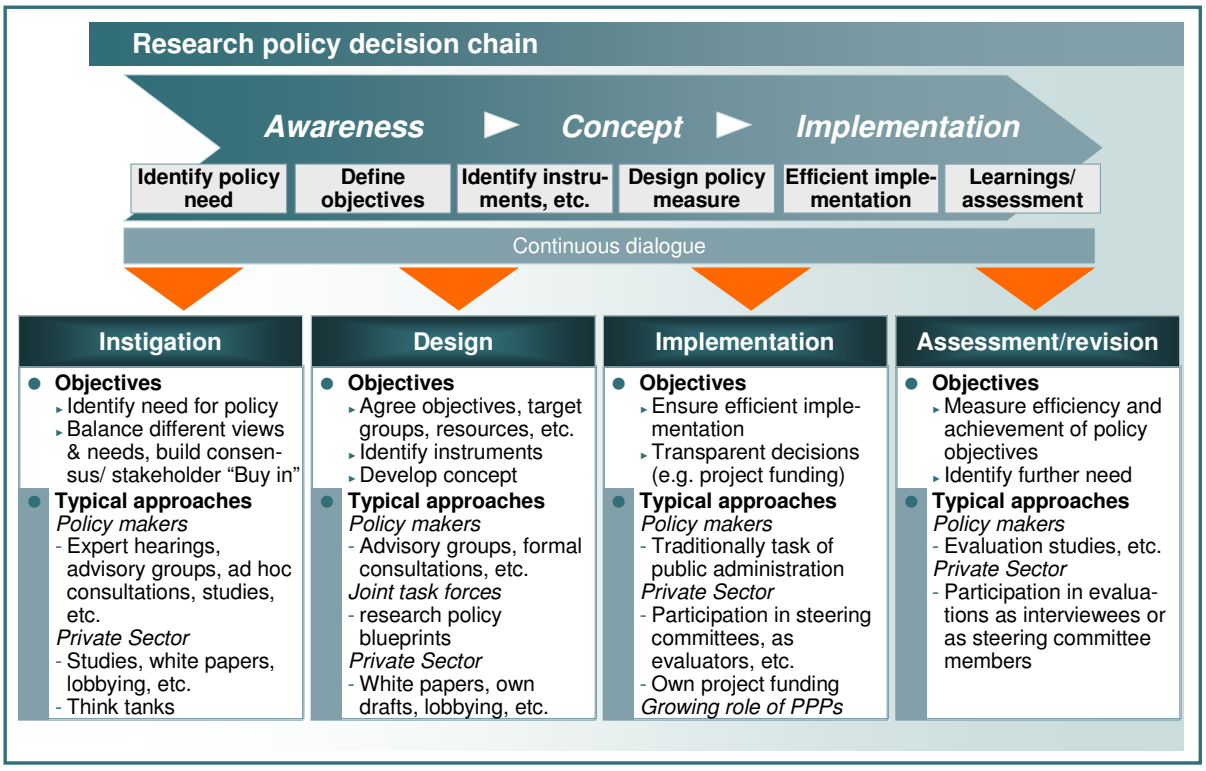

Figure 30 : The generic research policy decision chain in more detail

It is important to note that there is an additional hierarchy of research policy decision levels to be observed (See Figure 31):

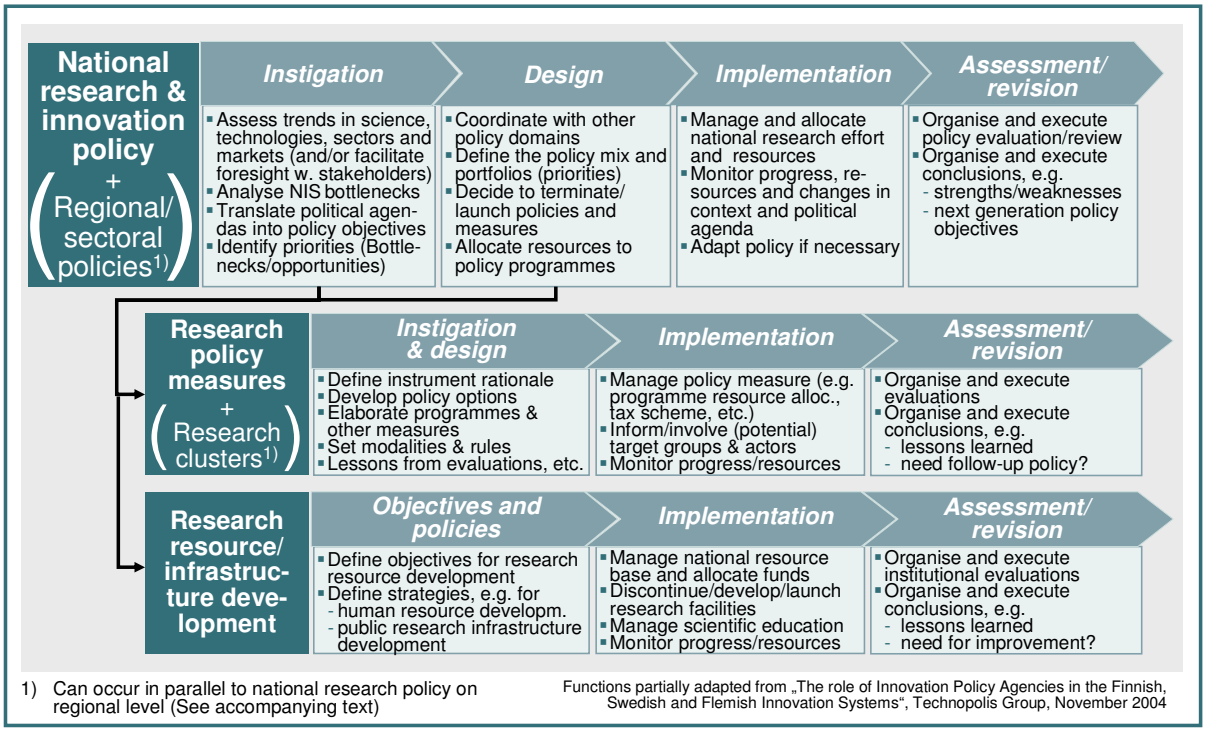

Figure 31 :Levels and major functions of public research policy decision making

- Especially in National Science and Innovation Systems with a central governance structure, *national research policy* forms the overarching framework for all following research policy levels. In mixed or decentral governance structures, this level is complemented[84] increasingly by *sectoral and/or regional research policies*.
- Based on the objectives and priorities defined therein, research policy objectives are implemented through *'direct' measures* (e.g. individual research programmes) and/or *'indirect measures* (for example tax incentives). This can take place at a national or regional level. This creates additional decision levels:
  - In research programmes, the programme responsibles initiate comparable decision cycles, focussing on priorities and elements of programmes, instruments to be applied etc. and on their implementation and assessment.
  - Decisions on 'indirect' measures involve typically a larger number of Public Sector decision makers (including for example ministries responsible for economic or financial affairs, etc.). This creates an additional level of complexity for an efficient Private Sector interaction.
  - At the operational level (e.g. in research and innovation clusters), decisions are mostly taken by the actors themselves. This implies a very direct and (co-)decision oriented interaction between the involved Public Sector and Private Sector actors.
- A third level of research policy decisions is created by the need to maintain and develop the necessary infrastructure and resource base for Public Sector research. This level requires different types of decisions, related for example to maintenance and development of the national portfolio of research and higher education institutes, strategic investment in large scale research facilities or higher scientific education and training issues. Traditionally, there has been little Private Sector interaction on this level. But the industry's increasing withdrawal from own R&D without immediate commercial impact and other con-

[84] In highly decentralised structures like Belgium, these can even become dominant, reducing the decision space for national research policy to a limited number of issues.

cerns, e.g. about possible shortages of necessary highly qualified scientific staff seem to create a growing Private Sector interest also in this area.

These three levels create different arenas for decision making, where policy makers at different levels have to take distinct types of decisions. This induces also different needs for Private Sector interaction, resulting in different approaches to this issue.

However, the underlying basic assumption at all levels is that involving stakeholders in these decisions in an appropriate form can improve the quality of decisions and contribute to building common consent and – where possible – consensus while safeguarding the specific role and objectives of each party. The 'classical' form of such an involvement is consultation, which can take many forms. At its most basic level, this is simply the exchange of information and opinions. However, it covers also the communication of actions or decisions which governments have already taken or may be about to take and which have a direct or indirect bearing on the interests of other stakeholders. It may also involve advance warning of actions or decisions to be taken by governments in the future, in order to provide an opportunity for stakeholders to endorse or commented them or to propose alternatives. In an extended view, it can encompass discussion with the aim to reach a consensus on research policies to be adopted or actions to be taken. The ultimate is then to enable policy makers and stakeholders to arrive at mutually acceptable agreements, collective decisions or joint action[85].

But over time, a more comprehensive set of mechanisms, instruments and organisational set-ups for Private Sector involvement has emerged. In the course of this development, the perception of the nature of Private Sector interaction has also changed. Previously seen primarily as an occasional exchange on specific issues, Private Sector interaction is considered today much more as a going concern which accompanies all stages of research policy decision making (see Figure 32).

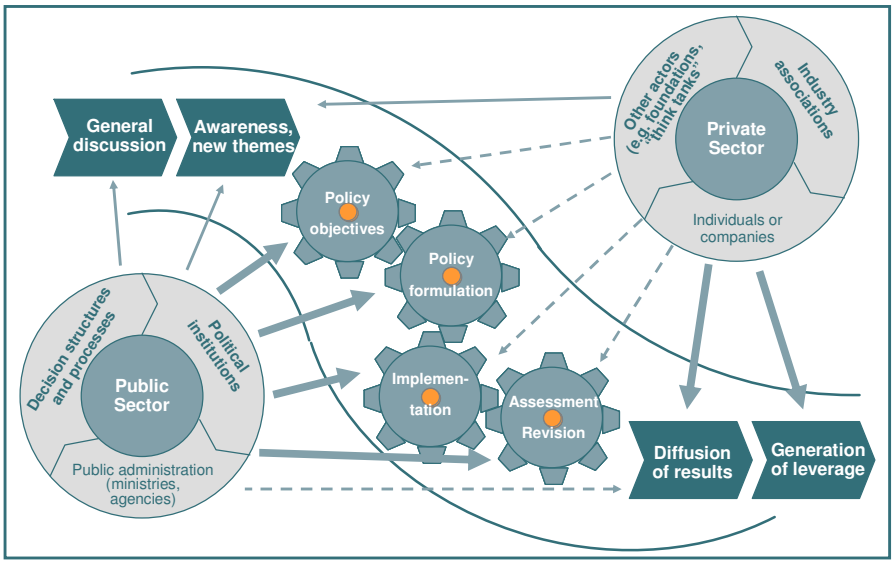

Figure 32: Private Sector interaction as a going concern

A4.3 Research policy decision making and Private Sector interaction therein – a rational process?

Administrative structures, in which research policy decision making takes place, can be described by means of institutions and rules. These define the actors and which of them have the power to make decisions, to prepare policy proposals and to influence for instance decision makers. But governments are not acting as 'monoliths' in research policy decision processes. The efficient use of public resources and of related decision processes depends crucially on institutional features of the state, formal allocation of responsibilities and decision processes, the overall policy framework and on incentive schemes in public organizations. Chapter A4.1 has also shown that just like in other policy areas, research policy decision making is a complex set of political processes, governance structures and agency relation-

[85] Text adapted from NATO 2001, Part II, Chapter 7 Policy and Decision Making

ships. In these, politicians, government institutions, agencies, researchers, Private Sector and other stakeholders pursue their objectives independently and interact with each other.

In a first approximation, such a system can be described as a *rational (or rational-comprehensive) model. This* assumes that policy making is 'rational' in the sense that it follows a logical and ordered sequence, assesses all options and seeks a fair balance between the interests of the involved stakeholders, calculating all the social, political and economic costs and benefits of a public policy. Collection and analysis of all relevant data provides policy-makers with additional certainty. Extensive communication and consultation supports a 'problem-solving' approach to policy making.

Under this view, Private Sector representatives act as providers of relevant information to the policy process. Knowledge cumulated over time through the activities of Private Sector and other policymaking actors (e.g. government agencies, commissions of inquiry, issue networks, individual policy entrepreneurs, the media, and other interest groups) becomes incorporated into policy making practice and gradually alters decision-makers perceptions of both the causes of problems and of the likely effects of policy interventions[86].

The rational model has been criticised extensively (see for example Lindblom 1980) because it allegedly assumes that stakeholders have access to full information and that information and knowledge are seen as neutral or apolitical and used in a neutral way to identify the best policy option. It does indeed assume that decision making follows rational patterns governed by generally accepted rules and that decision-makers will be persuaded by the most accurate or scientifically plausible option which creates the maximum benefit for society.

In reality however, decisions are not taken in such a hyper-rational mode. Even if rules are laid down in laws and regulations, they are usually only a part of the factors affecting research policy decision making[87]. Different views on how issues should be addressed compete for supremacy. Driven by their individual problems and solutions, different actors seek recognition of their policy proposals. Obviously, the resulting policy plan is not only based on a rational consideration which of the possible options is the one which best meets the sum of all requirements. In addition, the aims of policy-makers are often limited to satisfying immediate public demands, not to maximising long-term social gains. Rather than searching out all alternatives, policy making often relies on existing policy paradigms[88] and/or stops as soon as a workable option is identified. In fact, emotional or irrational elements are an important part of decision processes. The outcome depends also for example on the relative power of the actors and their information base, the representation of information and proposals and the methods how decisions are derived[89].

Cognitive sciences propose that ideas, concepts, normative criteria and other decision-relevant information are copied from individual to individual. When hearing an argument why a specific action should be taken, decision makers might remember it and repeat it to others, or incorporate it in a proposal for a policy plan. Thus, ideas, concepts and data are transmitted from individual to individual, from organisation to organisation or from report to report.

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86 This paragraph draws partially on Stone 2001.

87 For example, Dethier 1999 gives an overview over the determinants and effects of public governance and discusses how political rules and law both constrain and facilitate economic activity and how informational, transactional and political constraints on government activity lead to trade-offs between efficiency and the extraction of benefits for private firms, politicians and government agents, thus producing welfare-increasing or welfare-decreasing outcomes.

88 A 'policy paradigm' is "an overarching framework of ideas which structures policy making in a particular field" (Hall 1990). Paradigms are largely taken for granted and rarely subject to scrutiny.

89 H. Simon uses the term 'bounded rationality' to describe this phenomenon (Simon 1976). He states that "boundedly rational agents experience limits in formulating and solving complex problems and in processing (receiving, storing, retrieving, transmitting) information" (quoted in Williamson 1981, p. 553).

The interpretation of such information by decision makers differs, depending on their overall level and perception of available information, personal/institutional criteria and 'filters', etc.[90]

This has important implications for Private Sector interaction in research policy making. Information and ideas from Private Sector actors compete with other influences for the attention of Public Sector research policy decision makers. For an efficient interaction it is therefore essential that

(1) Private Sector stakeholders undertake a conscious and dedicated effort to gain the attention of policy makers, to establish credibility and a continuous dialogue and to convey their messages.

(2) Public Sector decision makers pay sufficient attention to the needs and ideas of the Private Sector, allocate appropriate room and weight for their perceptions in their decision criteria and ensure the transparency of research policy decisions.

(3) both sides provide arenas for a sustained interaction and establish mutual trust, transparency and a communication culture.

Under this extended view, the possibilities of an individual interest group like the Private Sector to act as advocates of their perceptions and interests are limited. Policy-making under policy paradigms tends to focus on incremental change as long as there is no important incentive for politicians to seek out and embrace new paradigms, maybe even perceived as the ideas of their opponents (see Hall 1990 and Stone 2001). Hall outlines three different orders of policy change or learning that take place within this framework:

- In *first order change*, the legitimacy of the overall policy framework is not questioned and policy making consist of 'satisficing[91]' (minor adjustments to policies). Under these conditions, the impact of Private Sector interventions is limited to marginal corrections within existing policy paradigms, mostly in a consulting role. New ideas and concepts which conflict with current policy paradigms will not be able to induce major change.
- *Second order change* and learning arises when 'satisficing' fails. Existing policy is reassessed and limited experimentation and new policy techniques occur. But policy-learning still takes place within the existing policy paradigm, which is not questioned. Under such circumstances, Private Sector representatives have good chances to challenge existing policies and to suggesting improvements in a collaborative mode.
- *Third order change* (or 'social learning') involves a radical policy shift if first and second order changes cannot resolve problems caused by the existing policy paradigm. Problems are redefined, new interpretative frameworks are developed, and policy learning from external sources takes place. The Private Sector now has the opportunity to bring forward radically new ideas and to participate actively in policy instigation and formulation.

Profound changes of research policies require a strong dedication of policy makers to take risks and the 'buy in' of the other stakeholders. The first impetus for such change, which points to deficits of current policies and to an urgent need for radical action, can come from policy makers, from advisory bodies/institutions or from the stakeholders themselves. If the overall objectives of policy makers and other stakeholders coincide, this leads to a collaborative approach to develop new policies. However, there may also be a dissent, where stakeholders promoting change do not succeed in convincing policy makers and/or other stakeholders. The opposite, is represented by the German BioRegio initiative, where the strong conviction and dedication of policy makers was necessary to enable a turnaround in what seemed to be an already lost battle for a strong German Biotechnology research and innovation system (See page 20).

[90] For a detailed discussion of interaction aspects in policy processes, see for example Speel 1997.

[91] The word *satisfice* was coined by Herbert Simon in 1957. It denominates a behaviour which attempts to achieve at least some minimum level of a particular variable, but which does not strive to achieve its maximum possible value.

Appendix A5 Case studies

A5.1 Case study: The BioRegio competition – cluster-oriented policy to develop the German Biotechnology sector

1. Policy and institutional context

In the mid 1990's, Germany's biotechnology sector was in danger to 'miss the boat', because it's macro-economic development was lagging behind other leading industry nations considerably. The launch of the BioRegio programme 1995 has been a landmark in the 'turnaround' which has brought Germany back to the global competitive landscape in this sector. BioRegio has stimulated the development of research and innovation in regional clusters. Together with complementary policy measures this has been the cornerstone of the successful reorientation of German Biotechnology research and innovation policy.

Molecular biology had been identified as a future key technology as early as 1974 by a high level commission (composed half of scientists and half of industry representatives), initiated by the German government. In 1976 a first policy study, commissioned by the responsible federal ministry[92] explored the potential and needs of Biotechnology Research funding[93]. Based on these recommendations, the research ministry started to stimulate research for broad scientific goals (e.g. bioprocessing (fermentation and enzyme technology), 'SCP' (Single Cell Protein), etc.) and founded a national lab to conduct biotechnology research (the Gesellschaft für Biologische Forschung, Braunschweig, GBF). But in this period, most German pharmaceutical and chemical companies maintained their focus on traditional technologies and showed little interest in genetic engineering despite scientific breakthroughs in DNA recombination achieved since 1973. Therefore there was no impetus for further policy initiatives going beyond basic research.

The rapid development of biotechnology in the US in the early 1980s and Hoechst's 1981 decision to invest $50 million dollars to build a genetic research facility in Massachusetts induced a revision of German biotechnology research policy. It was recognized that Government's promotion strategies had not been sufficient to create a strong biotechnology sector in Germany. For these reasons, the research ministry decided to increase its spending in support of innovative research and of technology transfer with an increased emphasis on third generation biotechnology[94]. In addition, 'Gene Centres' were created in the cities with the strongest biotechnology infrastructure, i.e. Munich, Heidelberg, and Cologne (and later Berlin). These were co-financed by the BMBF, by the state (Bundesland) hosting the Centre and by an industrial partner with a special interest in the Centre.

After a preparation by further studies conducted by groups of scientists and industry experts, the Research Ministry announced 1985 its first programme for *Applied Biology and Biotechnology*. Subsidies for biotechnological R&D were more than doubled between 1984 and 1988. This programme introduced also specific funding instruments to foster industry/academia collaboration for industrial research (so-called 'indirect-specific' measures)[95]. But despite the word 'applied' in the programme's title, basic research and funding of public research institutes remained the priorities, receiving over two thirds of funds. The following programme *Biotechnology 2000*, published 1990, confirmed government's commitment to strengthen research and to improve the framework conditions for Private Sector research in this area.

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92 The Federal Ministry for Research and Technology (Bundesministerium für Forschung und Technology, BMFT), was renamed 'Federal Ministry for Education and Research (Bundesministerium für Bildung und Forschung, BMBF) in the late 1990'as. To facilitate readability of this report, the ministry shall be referred to as 'research ministry" consistently throughout this report.

93 *Biotechnologie; eine Studie über Forschung und Entwicklung – Möglichkeiten, Aufgaben und Schwerpunkte der Förderung*, Dechema, 1976

94 Before, Germany's research policy maintained a focus on second generation biotechnology (bioprocessing) goals, giving little attention to the possibilities of the very new third generation or post-DNA recombination goals (such as genetic engineering).

95 In parallel, a programme providing venture capital to small technology-based companies was also open for the Biotech sector. But it turned out to be not very successful.

The Private Sector was involved in this gradual development of a German Biotechnology research and innovation policy. For example, a series of high level discussions ('Industriegespräche') were co-organised by the BMBF, the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG) and the Association of the Chemical Industry (VCI).

But despite this increased state spending, the gap between academic research and its conversion into economic success persisted. German biotechnological innovation and commercial performance remained mediocre, compared with the US. As the need for a radical 'rethink' of Germany's biotechnology policy became obvious in the early 1990's, a reorientation of German biotechnology research and innovation policy was initiated under the leadership of the research ministry[96].

A crucial problem was the absence of small dedicated biotechnology companies and start-ups from academic research, which play an extremely important role in driving discovery and commercialization of knowledge according to the US experience[97]. In addition, industry had withdrawn from a further financing of the Gene Centres and larger companies that were able to set up 'off-shored' research and production facilities created such facilities in foreign countries, mainly in the United States[98]. A third element contributing to this situation were the uncertain and fragmented regulatory environment and an intensive political debate. These were often referred to as the major reason why it would not be attractive for Private Sector companies to invest in research or production facilities in Germany.

To prepare the ground for a new Biotechnology policy, the research ministry launched several studies. One of these studies[99] analysed innovation obstacles and recommended a more integrative approach to the biotechnology driven innovation process and a stronger emphasis on clusters. In addition, the research ministry intensified the debate with the stakeholders. A typical example was a workshop *Perspectives of Biotechnology – Medium Sized Enterprises in Germany*, held in the summer of 1994. At this event, technology and market perspectives and trends, were discussed with participants from all stakeholder groups, in particular from the Private Sector to enhance the awareness of this group of actors and to foster an exchange of experiences among and with them. During the design phase of the new programme, another workshop was organised for example by the research ministry in collaboration with DECHEMA (Society for Chemical Engineering and Biotechnology) to discuss possible policy options with representatives of industry, research and other administrative bodies involved in related policy areas.

This process, initiated and managed by the research ministry, paved the way for the following redefinition of Germany's biotechnology research and innovation policy. The core of this new policy was the introduction of a new complementary policy instrument, aiming at the stimulation of research and innovation in dedicated regional clusters through interregional competition. This decision built on a thorough analysis of success factors for the development of Biotechnology in the US and on two particularly important insights: (1) The successful experience with the Gene Research Centres had confirmed the value of a collaborative

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96 In parallel to the described research policy development, a set of new legal and administrative frameworks was develop to ensure competitive legal/administrative conditions for biotechnological research, development and manufacturing on an international standard.

97 Estimates placed the number firms active in biotechnology in the US at 388, and in Germany at 17 (Source: A. Lux, *Die Wettbewerbsposition Deutschlands in der Neuen Biotechnologie*, Wirtschaftsdienst 73 (1993.), no. 7, pp. 369-74)

98 Hoechst and Bayer each had over a dozen different biotechnology collaborations with universities and biotech firms in the US. Bayer had one dedicated biotechnology lab in Germany, while Hoechst had none (Source: Sharp, M. and Patel, P. 1996, *Europe's pharmaceutical industry: An innovation profile*, Draft Report Prepared for DG X111, European Commission, quoted in S. Casper, C. Matraves, *Corporate Governance and Firm Strategy in the Pharmaceutical Industry*, Discussion Paper FS IV 97 - 20, WZB Social Science Research Center Berlin, 1997; accessible under http://skylla.wz-berlin.de/pdf/1997/iv97-20.pdf)

99 *Biotechnologie – Abbau von Innovationshemmnissen im staatlichen Einflussbereich*, Motor Columbus Ingenieur AG, Köln, 1989

development in centres of excellence, together with regional authorities, Private Sector and academic research. (2) Obviously, traditional research funding schemes alone would not be enough to stimulate innovation, industrial investment in Biotechnology in Germany and enhanced start-up activities to the desired extent. The development of a competitive scientific, start-up and industrial base had to be stimulated and seamless innovation chains were necessary to take new scientific results rapidly from the lab to the market place. The key to achieve this would be a stimulating environment favouring the formation of start-ups and of interdisciplinary networks involving both public and Private Sector actors. For this purpose, a regional set-up aiming at the formation of regional clusters emerged as the instrument of choice among possible policy options.

2. Detailed description

2.1 BioRegio Programme

BioRegio was the prototype of a new German research policy approach, which used interregional competition to stimulate the formation of designated biotech regions as centres of growth. The winning regions got access to special federal funding for a period of five years. The top three applicant regions were awarded federal funding of DM 50 million each over five years. An important condition was that for any project in these regions, this public funding had to be matched by grants from the Private Sector of at least the same volume[100].

For this purpose, an open call for tenders invited regional actors to prepare their own concepts for the formation and development of research intensive, innovative Biotechnology clusters immediately after the announcement of BioRegio in October 1995. It did not request a specific size or organisational framework. The contesters were free to define these in accordance with their specific needs and ideas. 17 proposals were prepared by competing Bioregions from all parts of Germany.

BioRegio Evaluation Criteria	
1	Number and scale of existing biotechnology companies in the region
2	Number, profile and productivity of biotech research facilities and universities in the region
3	Interaction of different branches of biotechnology in the region
4	Supporting service facilities (patent attorneys, information networks, consulting)
5	Strategies to convert biotechnology know-how into new products, processes or services
6	Regional concept to help start-up biotech companies
7	Provision of resources (private and public) to finance biotech companies
8	Cooperation among regional biotech research institutes and clinical hospitals in the region
9	Local authorities approval practice concerning new biotech facilities and field experiments

Table 1:Evaluation criteria of the BioRegio contest[101]

These applications were evaluated by an international panel of experts, including Private Sector representatives. At the end of 1996, three winners were chosen (Munich, Rhineland, and the Rhine-Neckar-Triangle). Beyond these three representatives of traditional industrial clusters with an already developed broad scientific and industrial base and entrepreneurial activities, the small region of Jena in Eastern Germany was given a 'special vote' for their ambitious and focused biotechnology development concept after German re-unification.

Over 90 Mio. Euros of funding were provided for over 100 projects in these regions since 1997. As an additional incentive, companies from these regions were granted preferential access to the funds of the general federal programme *Biotechnology 2000*.

[100] BioRegio was embedded in a broader policy approach, described in the programme *Biotechnologie 2000*, which was published 1996. BioRegio accounted for only 21% of all research ministry funding for life science research in the period 1996 – 2001 (Source: Consultech 2001).

[101] Source: BMBF 1996

It should be noted that in the selection of individual projects, the federal government largely relied on the judgement of regional experts, where Private Sector representatives played an important role. The winning regions organised the process of generating, collecting and evaluating project proposals themselves and made recommendations for projects to be funded. In general the research ministry's funding decisions followed these recommendations.

2.2 Regional BioRegio implementation

The open concept of the BioRegio competition permitted the winning regions to pursue individual approaches shaped to their specific needs. As a consequence, some of them invested aggressively in large, ambitious projects while others pursued a more conservative strategy.

The development of the *BioRegion Rhein-Neckar Triangle* is a representative example for the develop of such a winning regional initiative, stimulated by the BioRegio programme[102]. Immediately after the call for applications was issued, the initiative group 'BioRegion Rhein-Neckar Triangle' was constituted upon the initiative of the University of Heidelberg. It united over 40 regional Public and Private Sector actors, dedicated to prepare a winning application in the BioRegio competition. For this purpose, a steering committee was established to coordinate all activities and to prepare an integrated concept for the enhanced application and implementation of Biotechnology in the region.

The core of this effort was a systematic analysis of the regional scientific potential using a questionnaire which was distributed to all actors. This yielded approximately 180 project ideas, whose scientific and commercial potential was evaluated by 12 ad-hoc working groups. These working groups consisted of representatives of the involved scientific institutions and of industry and biotechnology companies. The results were discussed at a joint symposium.

As an organisational framework for implementation, Biotechnology Center Heidelberg (BTH) was founded as a virtual organisation with three (legally independent) elements:

- *BioRegion Rhein-Neckar-Dreieck*, a not for profit association provides a platform for the interaction between the public and the Private Sector members. Its task was to support the protection and transfer of scientific progress and to help 'kick start' projects. In addition it hosted also a high level steering group which was established to select the projects to be funded. This group consisted of each six representatives of academic research and of the Private Sector (4 industry, 1 SME, 1 finance sector).
- As the association consisted of unsalaried members, it used the services of *Innovation GmbH Heidelberg* (which has the legal form of a private limited company). Its tasks include the professional management of the network's activities and support for marketing of innovative products resulting from the network's activities. It is financed by its shareholders, the participating industrial companies. Innovation Heidelberg's services for start-ups, etc. are reimbursed by its clients either directly or in the form of shares.
- As BTH's seed capital fund, *Heidelberg Innovation GmbH & Co. Bioscience Venture KG* acted as lead investor for early stage projects[103]. The objective is to provide a first initial funding for early projects which usually would have problems to find other sources of financing and to attract co-investments from other investors, especially from the financial sector partners of BTH.

Other important complementary elements of the winning regional concept included a collaborative professional training programme 'Bio-Business School' to strengthen and disseminate the necessary skills, measures to foster the exchange between private and pubic sector research (e.g. research sabbaticals, shared laboratories), the organisation of conferences and specific measures to improve public acceptance of biotechnology in the region.

[102] For a summary description of the other two winning regions, see Adelberger 1999, pp. 14 ff.
[103] Today, Heidelberg Innovation has expanded its activities to a broader range of Venture Capital related services.

Policy development after BioRegio

Based on the positive experience with BioRegio, Germany's post 2000 Biotechnology research policy was defined in the new framework programme *Rahmenprogramm Biotechnologie –Chancen nutzen und gestalten* (published 2001). It continued the proven dual approach of combining 'classical' research funding with cluster-oriented policy measures focussing on specific regions and target groups. However the initial approach was modified to account for changes in the environment and for the learnings from BioRegio. Since 1995, a multitude of successful Biotechnology clusters had emerged and the legal/administrative framework had been revised. During the time of the BioRegio competition, there was still a considerable need for venture capital. But the number of Venture Capital companies which invest in biotechnology had increased from less than ten in the early 1990s to more than 150 in 2001.

For these reasons, the next generation of cluster oriented German Biotechnology policy approaches was refined in the following sub-programmes[104]:

- Following the patterns of BioRegio, in the *BioProfile* competition regions compete for federal funding. The difference is that BioProfile seeks to stimulate clusters in specialised Biotechnology sub-segements, requesting a clearly defined profile. This provides opportunities for smaller regional clusters with a higher degree of specialisation.
- *BioChance* complements this regional approach by the provision of funds for research programmes carried out by young Biotechnology companies in close cooperation with universities and academic research. To support such projects which aim at the development of commercial products, but are still far from reaching the commercialisation level, 50 Mio. Euros were provided over a five year period. Six calls for applications in this period yielded over 300 proposals, out of which approximately 50 were selected. This initiative is continued by the follow-up programme *BioChance Plus* in the period 2004 – 2006.
- *Biofuture* aims at strengthening the research and innovation potential through the stimulation of young research teams with a high scientific and commercial potential. Until 2010 the BMBF provides 75 Mio Euro for such projects in order to support the creation of attractive working conditions for outstanding researchers and research groups.

Beyond the biotechnology sector, comparable research policy approaches aiming at the development of regional innovation clusters have been implemented. The most prominent example is InnoRegio, which tested as a prototype the applicability of this approach to stimulate regional nuclei for growth without a focus on a specific technology area or industry. While the objective of BioRegio was to develop Germany's competency in a defined target technology sector, InnoRegio aimed to unveil endogenous development potentials of regions, especially in the new German states.

BioRegio family	**InnoRegio family**	**Other programmes[105]**
BioRegio	InnoRegio	
Innovative Regional Growth Nuclei		Learning Regions
BioFuture	Interregional Alliances	InnoNet (Min of Economics)
BioChance	Centres for Innovation Competency	ProInno (Min of Economics)
BioProfile		InnoWatt (Min of Economics)

Table 2: Important programmes of German cluster oriented innovation policy[106]

[104] Focussed on policy measures aiming at cluster development. For a comprehensive overview, see http://www.fz-juelich.de/ptj/index.php?index=40
[105] Illustrative examples, not comprehensive
[106] Source: D. Dohse, 2005

3. Impact of Private Sector involvement and effectiveness in leveraging publicly funded RTD/stimulating Private Sector RTD investment

The BioRegio programme and its regional clusters were instigated, designed and implemented in close interaction with the Private Sector in a situation where a race to catch up was necessary to avoid that Germany missed the rapid development and potential of the biotechnology sector. However, the resulting drastic improvement of Germany's position as a well-performing Biotechnology research location has to be attributed to a large extent to the persistence of policymakers. Without this dedication, it can be doubted if the development of Germany's current Biotechnology 'landscape' would have followed the impressive growth path of the last decade. BioRegio and the larger policy approach accompanying it have been instrumental for the formation of biotechnology clusters, the significant raise of start-up activities and the improved access of SME's to biotechnology know how and resources.

It is generally recognized that the BioRegio competition has been a success attempt to stimulate and support the recovery of Germany's biotechnology sector. For example, Engel and Heneric state[107]:

> *'Regions with biotechnology-specific knowledge seem to have best chances to attract potential entrepreneurs to establish a biotechnology-firm. Furthermore, regional oriented technology policy is supposed to stimulate the creation process of biotechnology clusters, too. The BioRegio contest (BRC) is the most prominent example for this kind of policy support."*

At the time of preparation of this case study, the ex-ante evaluation of the BioRegio programme is still in progress, its results are expected later in 2006. But preliminary indications, based on available sources, provide already a first impression of its impact and efficiency. Three important effects can be identified:

a. 'Kick start' for the mobilisation of (potential) Biotechnology clusters

Already the fact that 17 regions applied for the initial funding confirms that BioRegio has met an inherent need and created a high level of awareness. The BioRegio competition and its selection mechanism created an excellent opportunity for a federal programme to influence the behaviour of regional actors. The incentive of winning millions of deutschmarks awoke broad interest of researchers and of Private Sector actors. This induced a high level of commitment to participate in the competition and to provide the necessary resources. It also created pressure on local authorities to provide full support from their side. The preparation of the BioRegio applications has not only in the winning regions been the starting point for joint activities which last until today. According to participants, the intense debate in the initiative and working groups during the concept development represented an intrinsic value, because it permitted the various stakeholders to get to know each other better, to create a 'common language' and to create networks whose impact goes far beyond the BioRegio initiative.

b. Development of the winning regions

Based on currently available documentations and literature, the effects of Bioregio can only be roughly estimated. The BMBF estimates that BioRegio and its successor programmes have mobilised investments of a total of over 1 Billion Euro. Of this sum, approximately 90 Million Euro were funded directly by the BioRegio programme and another approx. 50 Million Euro by other elements of the BMBF biotechnology programme. The remainder (i.e. approx. 90% of all investment in R&D, startup companies, research and manufacturing facilities, etc.) has been supplied by the regional actors, in particular by the Private Sector companies involved.

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[107] Source: Engel, D. and Heneric, O., *Stimuliert der BioRegio-Wettbewerb die Bildung von Biotechnologieclustern in Deutschland - Ergebnisse einer ökonometrischen Analyse*

The regional effects achieved are demonstrated by Plate's estimates for the Rhine-Neckar-Triangle[108]: 55 new biotech companies have been founded in this region in the period 1997 -2003, creating 1800 jobs (45 research driven companies in molecular biotechnology with 1500 jobs). 14,000 more jobs are dependent on biotechnology (8,000 in industry, 6,000 in research institutions).

In the three winning regions of the BioRegio competition, the links between Public and Private Sector actors, joint research and innovation activities in clusters and the support for biotechnology based start-ups have grown considerably. And significant local funding by public authorities, industry and financial institutions has been mobilised.

c. Germany wide mobilisation of Biotechnology potential in participating regions

BioRegio has been at the core of the successful reform of Germany's biotechnology promotion policies and the development of regional biotechnology clusters. BioRegio has served as a catalyst to kick-start Germany's biotechnology industry. This is illustrated by the fact that the impressive development of biotechnology activities and competencies has gone far beyond the winning regions of the competition. Participating (non-winning) and increasingly also non-applicant regions have also been mobilised.

The participating (non winning) regions seem to have benefited particularly from BioRegio. 60% of all biotechnology companies newly founded in the period 1995 – 2003 were founded in the BioRegio winner regions and those participating in the competition. But the share of the participating regions of all newly founded companies rose from 29,4% in the period 1995 – 1998 to 41,5 % in the period 1999 – 2003. Another indicator confirms this effect: In the participating regions, the founding intensity[109] has also almost doubled from 9,5 (1995-1998) to 18,9 (1999-2003), while the winning regions as well as the non participating regions only had slight increases[110].

As the cornerstone of the reorientation of Germany's Biotechnology research policy, BioRegio has had a significant influence. According to Dose 2005, this has generated the following advantages and disadvantages:

- A *stronger regional orientation of research policy* stimulates the early formation of knowledge clusters in promising key technology areas and supports successful cooperation and spill-overs in regional networks (which are – according to literature – most suitable for such processes).
- *Competition between regions* stimulates the 'experimenting' with new, dynamic forms of regional collaboration, the formation of clusters and a more supportive attitude of regional authorities in favour of increased innovation dynamics.
- But a policy of 'backing the winners' also bears (1) the risk of 'putting all eggs in one basket' (i.e. investing in perceived winning technologies based on false assumptions and expectations) and (2) the risk of further widening the gap between the winning and other favoured regions (which had already a strong base in Biotechnology before BioRegio) and other regions which do not have an equal chance to develop new strengths.

[108] K. Plate, *Biotechnology in Germany. From BioRegions to BioClusters. Keys for Success*, Presentation at Bangalore BIO 2003, Bangalore, India, accessible at http://www.bangalorebio.com/events/ bio2003papers/Klaus.pdf

[109] Measured as the number of newly founded biotechnology companies per 10.000 potential founders (=R&D employees in the Private Sector and in public research institutions)

[110] All data in this paragraph quoted from Engel and Heneric.

4. Conclusions and transferability

The successful extension of the BioRegio model to the next generation of German Biotechnology policy programmes confirms the value of this competition based instrument for the stimulation of technology driven clusters. However, in the assessment of its transferability, the following important lessons from the German experience should be taken into account:

- BioRegio-type instruments support the development of sectoral regional strengths, but they are not 'stand alone' approaches which replace traditional instruments. They should be embedded in a comprehensive policy concept which combines them with other mechanisms to stimulate research and the transfer of its results in an appropriate way.
- Targeted technology areas must be sufficiently mature to provide attractive commercialisation potentials. The approach is not suitable for example for embryonic pacing technology areas.
- Such instruments can stimulate the dynamic development of existing structures. But they are unlikely to be successful in 'green field' development of new competency clusters. There must be a critical mass of regional know how and resources to permit the preparation of a successful application and as a starting base for cluster formation. In particular, there should be indications for a sustainable long term commitment of regional actors.
- On a national level, there must be (1) a sustained dedication to long term development of the targeted sector, (2) an overarching policy concept which links competition based cluster policies to other suitable measures and (3) enough potential cluster regions to permit a truly productive competition.
- On the level of implementation by the regional clusters, their freedom to develop and implement specific solutions developed by them seems to be strongly linked to their motivation. It is their own responsibility to develop efficient internal processes and a professional support organisation and to find solutions for typical challenges like the *Clash of cultures* between regional actors, the handling of confidentiality and IP issues, etc.

  In doing this, several key success factors emerged at this level:

  - Broad consensus and commitment from all important regional actors (including Public Sector research and education institutions, Private Sector companies, financial institutions, policy makers and administration);
  - Open and transparent processes which enable the creation of synergistic 'win-win' situations while at the same time protecting the intellectual capital and interests of the participants[111].
  - an efficient organisational setup (including a communication and discussion platform for exchange, consensus building and strategic decision making, a professional organisation for implementation and powerful 'champions' which drive the process[112].
  - Long term commitment of participants in a flexible strategic and organisational setup beyond the starting period (funded by the BioRegio competition) to achieve mutual benefit and a sustainable cluster development.

[111] For example in the case of BioRegion Rhein-Neckar Triangle, the open exchange on existing projects, technologies and ideas which led to new projects in the initiation phase was only possible because of a credible protection by non disclosure agreements, etc.

[112] For example in the case of BioRegion Rhein-Neckar Triangle, the commitment of a former high level senior Life Science industry executive, Prof. Abshagen, to act as the coordinator and 'project manager' turned out to be instrumental to set up the initiative, to gain the commitment of all necessary actors, to resolve conflicts and to ensure a professional project management.

Appendix: Additional important literature and information[113]

Literature

Adelberger, K.E., *A Developmental German State? Explaining Growth in German Biotechnology and Venture Capital*, BRIE Working Paper 134, 1999

Bundesministerium für Bildung und Forschung (BMBF), *Rahmenprogramm Biotechnologie – Chancen nutzen und gestalten*, Framework Programme for Biotechnology Research Funding, Bonn, April 2001, available at http://www.bmbf.de/pub/rahmenprogramm_biotechnologie.pdf

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Dohse, D., *Clusterorientierte Technologiepolitik in Deutschland: Konzepte und Erfahrungen*, Technikfolgenabschätzung, Theorie und Praxis Nr. 1, March 2005, pp. 33-41

Eickelpasch, A., Fritsch, M., *Contests for Cooperation – A New Approach in German Innovation Policy*, Freiberg Working Paper #3, Technical University Bergakademie Freiberg, 2005

Engel, D. and Heneric, O., *Stimuliert der BioRegio-Wettbewerb die Bildung von Biotechnologieclustern in Deutschland - Ergebnisse einer ökonometrischen Analyse*, Discussion Paper No. 05-54, Centre for Economic Research (ZEW), 2005

Reiß, T. and Hinze, S., *The Biopharmaceutical Innovation System in Germany, OECD Case Study on Structure, Performance, Innovation Barriers and Drivers*, ISI-Schriftenreihe Innovationspotenziale (ISI-B-48-04), Fraunhofer IRB Verlag, Stuttgart, 2004

Internet sources

http://www.bioregio.com/einf.htm	Overview Bioregions and policy initiatives in Germany
http://www.fz-juelich.de/ptj/index.php?index=40	Overview over BMBF's Biotechnology research funding by the responsible agency (Projektträger Jülich PTJ)
http://www.fz-juelich.de/ptj/datapool/page/494/BioProfileD_Intern.pdf	Short profile of BioProfile competition
http://www.fz-juelich.de/ptj/datapool/page/494/info6.pdf	Short profile of BioRegio competition
http://www.v-b-u.org/index.htm	Association of German biotech Companies VBU (part of DECHEMA)

[113] For basic information already quoted, please refer to the country report for Germany in this study.

A5.2 Case study: Research policy advisory structures in the Netherlands

1. Policy and institutional context[114]

The Netherlands have a long standing tradition of involving various stakeholders, including the Private Sector, in the instigation, design and review of policies through participatory, consensus oriented policy discussions. In the 1980s, a major attempt was made to open up the government policies with respect to science and technology to public debate and to steering by committees in which science and other stakeholders were represented. This new policy of public consultation was to open up earlier discretionary forms of policy making, to account better for public concerns and to give representatives of the stakeholder groups involved in research a say at an early stage. A typical example is a committee set up to discuss the impact of emerging new information technology and how Dutch industry and science could take part in the new generic technologies (*Rathenau Committee*). Industry was keenly interested in this committee, which was led by Professor G. W. Rathenau, a former director of Phillips' physics laboratory, and which comprised also other experts from the Private Sector.

Today's policy advisory structures and processes are the result of a restructuring which started in the 1990's. At that time, over 300 permanent and temporary advisory bodies existed to advise the Dutch government and its organs on various policy issues. This system was increasingly perceived as being overly complex, intransparent and inefficient.

A part of this effort was a reflection on the *Advisory Council for Science Policy* (RAWB), which was established towards the end of the 1960s to integrate the policy initiatives and routines in research, technology and innovation policy. As a consequence, the RAWB, until then the main national advisory body in this area, was reformed and put under the Ministry of Economic Affairs. Its name was changed to *Advisory Council for Science and Technology Policy* (Adviesraad voor het Wetenschaps- en Technologiebeleid, AWT).

Later, the historically grown, complex Dutch advisory 'landscape' was replaced by a new, lean structure. Twelve *high level advisory councils*, reporting to the cabinet and/or to the responsible ministries directly were established to cover all important policy fields. These include both councils with a functional focus on specific policy issues and sector councils, applying cross-functional skills to specific sectors of particular importance for the Netherlands. As one of the new functional councils, *AWT* was taken over from the previous system. The *Sector Councils* were created to review and give advice on the research activities and spending of the government in key sectors (health, environment and physical planning, energy, development aid etc.) In these Sector Councils, representatives of science, government and society (including NGOs and Private Sector) are equally represented in a tripartite form.

To provide the government with top quality, independent advice, these councils were established as autonomous bodies with a legal and resource base which secures their function and independence. A law, issued in 1997, and regulations based thereon, defined the roles, duties and rights of these councils, which are valid until today. This framework encompasses for example rules for membership in the councils and an obligation for the Government to react formally to statements of the councils within a given time frame.

During 2002, the awareness grew that there was insufficient progress towards the Lisbon agenda. This awareness and the need to counter economic recession lead to growing impatience of various key actors. Together with other voices[115], the employers' organisations VNO-NCW, MKB-Nederland and FME-CWM, pointed to the need for a national coordination body, such as the Finnish Science and Technology Policy Council (STPC). After the 2003

[114] This chapter describes only important major changes and trends as a background information. Please see chapter 2 for a detailed comprehensive overview.

[115] Others included the Association of Universities of Professional Education (HBO-raad), the Association of Universities in the Netherlands (VSNU), the labour unions (particularly CNV), educational organisations (among them SBO), governmental advisory bodies (SER, AWT) and civic groups (such as Nederland Kennisland).

elections, the coalition agreement of May 2003 expressed that innovation would be a priority of the new government policy. In August 2003, the Prime Minister initiated the *Innovation Platform* along the lines of the Finnish STPC. A first meeting took place in November 2003, and in that same month the Platform issued its first recommendations on International Knowledge Workers. The Implementation Office of the Innovation Platform became operational in January 2004. The Innovation Platform is installed by Royal Decree for a three-and-a-half year period, from 1 January 2004 to 1 July 2007.

Today, an intensive dialogue persists how to further enhance the Netherlands' innovation performance. In this debate, all stakeholders and advisory bodies described in section 2 take part intensively. For example, at the time of preparation of this report, several studies exploring such new grounds have been published or are under way[116] and an intensive debate about a possible reform of the sector council approach is taking place in the Netherlands.

2. Detailed description

Together with several other institutions, AWT and the Innovation Platform form the core of today's research policy advisory system as part of the Dutch National Innovation System.

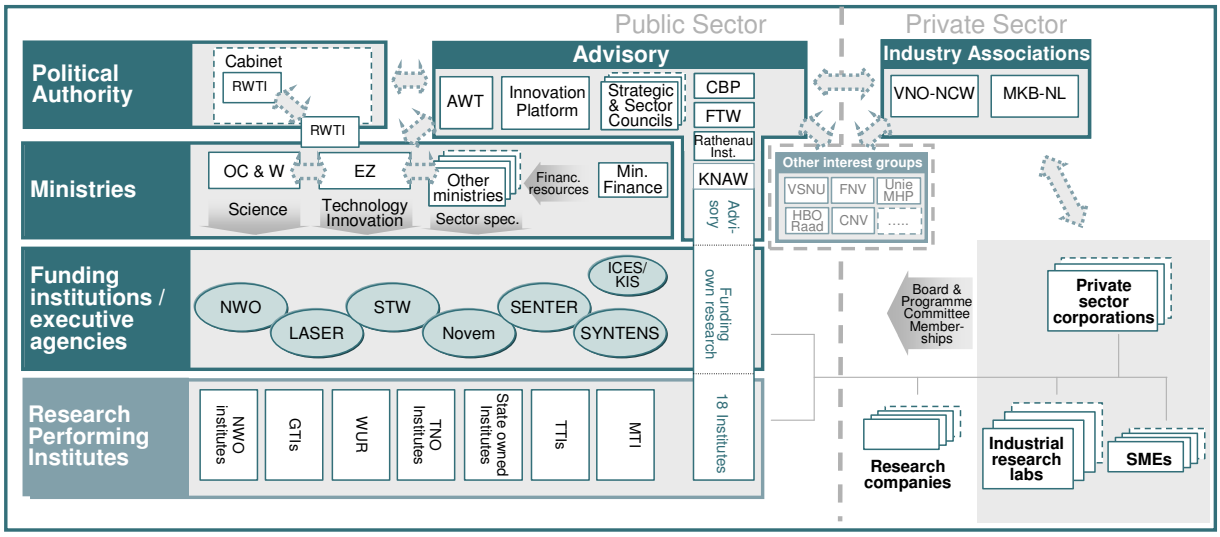

Figure 1: Advisory structures in the Dutch National Innovation System

On a national level, the 'clients' of research policy advice are the Cabinet, the responsible ministries and the agencies in charge of implementation. The Cabinet's decisions are prepared by the *Council on Science, Technology and Information Policy* (Raad voor het Wetenschaps-, Technologie- en Informatiebeleid**,** RWTI). An interdepartmental *Committee on Science, Technology and Information Policy* (CWTI), consisting of high-level civil servants, coordinates the work of involved ministries and decides which proposals to present to the RWTI. The Private Sector is not represented in these two committees. However, the advice of AWT, Innovation Platform and other advisory bodies (prepared with intensive participation of Private Sector representatives) is one of the most important inputs to policy making in this structure.

As the core of this advisory system, *AWT* and the *Innovation Platform* complement each other: *AWT* focuses mostly on middle to long term research policy issues of general high importance, for example the design of possible future main development lines of the Dutch innovation system. The *Innovation Platform*'s mission is to act as an 'ice breaker', which drives innovative approaches in research through specific initiatives. For this purpose, each

[116] See for example: *Knowledge for policy – policy for knowledge*, AWT Report Nr. 63, 2004, or E. Canton et. al, *Crossing boarders: When science meets industry*, CPB document Nr. 98, CPB Netherlands Bureau for Economic Policy Analysis, The Hague, October 2005

of them unites a group of high level representatives of the actors in the Dutch innovation system. Coordination between both is ensured by the fact that currently three members of AWT are also members of the Innovation Platform.

In some cases, this has led to a 'handshake', where the Innovation Platform has taken up recommendations of the AWT as basis for own action. For example, the AWT had recommended in 2003 a policy of 'backing winners'[117]. The Innovation Platform followed up on this with a call for tenders to identify such 'winners' in the Dutch economy, which could be further strengthened to ensure their international leadership.

However there are also some important differences in their mode of operation:

- The *Advisory Council for Science and Technology Policy* (AWT) advises the government and the parliament on research, technology and innovation policy and provides both solicited and unsolicited advice. However, it is mainly active in the areas of the Minister of Education, Culture and Science (scientific policy) and of the Minister of Economic Affairs (innovation policy). It operates independently of the Ministries and of other stakeholders.

  The Council was originally set up by an Act dated November 2, 1990 and was reinstated by the 1997 Advisory Bodies Framework Act. This framework ensures its independence (including financing, currently 50% by the Ministry of Economic Affairs and 50% by the Ministry of Education, Culture and Science) and defines its obligations and rights. For example there is an obligation for the government to react to statements or recommendations of the AWT within a given time.

  The Advisory Council consists of a maximum of 12 members, drawn from various sections of society such as research institutes and industry. The members are appointed in a personal capacity and do not represent any vested interests. Currently, approximately 50% of the members have a Private Sector background. An Office consisting of scientific and support staff supports the council and prepares its advisory reports. The AWT publishes its advice in the form reports, advisory letters and background studies.

- The *Innovation Platform* contributes specific proposals to stimulate the development and application of knowledge and the cooperation between knowledge institutions and companies. In addition, it also seeks to create a long-term vision on how to make optimal use of human talent and economic capital in the Netherlands.

  Currently, five working groups are operating, each headed by a member of the Platform[118]: Dynamics of the Dutch Innovation System, Long-term Choices, Moving up in higher education, Consultation Groups, and Innovation in Public Governance. In addition, the Innovation Platform initiates also different kinds of projects. In March and April 2004 for example, the Innovation Platform ran a number of Consultation Groups to identify practical barriers that stand in the way of excellence, ambition and entrepreneurship.

  Unlike AWT, the Innovation Platform has been established as a temporary body, installed by Royal Decree for a three-and-a-half year period, from January 2004 to July 2007.

  The 18 members of the Platform are key players in the Dutch knowledge economy and leaders in government, industry, academia and education. Prime Minister Balkenende is Chairman of the Platform. It is supported by an Implementation Office, in charge of project management and general support of the Platform.

A third group of important research policy advisory bodies are the *Sector Councils*. Their mission is to explore scientific and social trends in their sector and to derive an independent view of the priorities for strategic, medium-term and long-term research. For this purpose they carry out for example foresight exercises and other analyses which are used as input for

[117] See AWT report 53, 'backing winners' July 2003
[118] One working group (International Knowledge Workers) has already presented its results. New working groups will be established when the Innovation Platform requests them.

the concerned ministries' policy making and programming and co-ordination of research and organisation of the knowledge infrastructure in their relevant sector. Co-operation between the existing five sector councils is supported by the *Consultative Committee of Sector Councils* (COS), dealing with topics of common interest. The ministries involved fund the different sector councils and have the final responsibility for them.

The Sector Councils Framework Act on research and development (1989, amended in 1997), provides also the legal basis for the operation of the Sector Councils. However, there are two important differences compared to the previously described AWT and Innovation Platform: In a sector council three parties, i.e. researchers, representatives of society (including trade and industry) and government (as an advisory member) are represented. As a consequence, the Private Sector share of representatives is weaker, and government representatives are council members (in difference with AWT).

These bi- or tripartite research, technology and innovation policy advice platforms are complemented by other advisory institutions under the auspices of the Dutch government:

As an independent institution, the *CPB Netherlands Bureau for Economic Policy Analysis*[119] provides policy advice on the basis of its highly recognised economic research and modelling competencies, increasingly also on research policy issues. CPB conducts its analyses free of charge and has recently made important contributions to research policy issues. It is noteworthy for this study that, according to CPB's constitution, employers' organisations are among the limited group of institutions which have the right to call on CPB's research efforts[120].

One of the tasks of *the Royal Netherlands Academy of Arts and Sciences (KNAW)* is to advise government on matters of science and technology, especially in the field of basic research (code of conduct, quality assurance, research schools). For this reason the Academy has several councils and committees with members and non-members of the Academy. Solicited and unsolicited advice is given to government, parliament, universities and research institutes, funding agencies and international organisations[121].

The *Rathenau Institute* is the national organisation for Technology Assessment (TA). It was established in 1986 as NOTA (Netherlands Organization for Technology Assessment), following one of the recommendations of the Rathenau committee[122]. Its initial mission was to advise the government about the societal implications of technological change in nanotechnology, biomedical technology and other technological subjects and to stimulate civic debate through conferences, etc. At the request of Ministry of Education, Culture and Science, this scope was extended in 2004 to Science System Assessment to describe and analyse the current status of science and technology in the Netherlands. The institute's projects involve a wide range of actors - citizens, stakeholders, and experts. Its advisory and reading committees consist mostly of scientific experts, the Private Sector is represented by an industry expert on its board.

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119 Although CPB's Dutch name (literally translated: 'Central Planning Office') may suggest, it does not plan the Dutch economy. It rather provides independent economic analysis for policymaking.

120 CPB conducts research on its own initiative or upon request by a limited group of institutions. The bureau is allowed to work only for the Cabinet, government ministries, the Parliament, individual members or factions of Parliament, and political parties. In addition, employers' and employees' organisations, the Social Economic Council and several other institutes and organisations in the field of social economic policy and research can call on CPB's research efforts.

121 The overall mission of KNAW is to stimulate scientific research. Other tasks include peer review to ensure *the quality* of scientific research, the promotion of communication within the scientific community and of international scientific collaboration and the responsibility as *an umbrella organisation* for 18 institutes engaged in basic and strategic research and scientific information services.

122 Renamed in 1994 after the chairperson of the committee.

As an independent[123] platform for exchange on research and research policy issues, the *Netherlands Society of Technological Sciences and Engineering* (Forum voor Techniek en Wetenschap, FTW) seeks to advance the understanding of interactions between technology, science and society and furthers contacts between research decision makers from all sectors with government institutions, social groupings and political bodies. FTW' plenum or working parties discuss technology, research and education policy issues and advise with or without request government, societal organisations or political parties. Membership is limited to approximately eighty distinguished professionals from industry, universities and (applied) research organisations, who are chosen by peer election. The Technology Committee of VNO/NCW, the employers' organisation, occupies one quality seat, as do the Royal Netherlands Academy of Arts and Sciences and the Royal Institute of Engineers.

As a last element, statements from employers' and industry associations, prepared for example by VNO-NCW's Technology commission and the presence of a multitude of Private Sector representatives on boards, programme committees, etc. of executive agencies and research performing institutions, complement the advice available to the Netherlands' policy making institutions in the area of research policy.

3. Impact of Private Sector involvement and effectiveness in leveraging publicly funded RTD/stimulating Private Sector RTD investment

Overall, the described advisory system provides efficient instruments for the Private Sector to contribute to the Netherlands' research policy on an advisory and consultative level. In particular, Private Sector representatives play a key role in the AWT and the Innovation Platform. Through this the Private Sector has its say in the early stages of policy instigation and design, which ensures that his views and needs are fully accounted for in the shaping of long term research policy options. The high degree of institutionalisation of institutions like the AWT gives this committee considerably more impact on policy making than an advisory body without its formal rights, own resources, etc. would have.

This has enabled the Private Sector to raise policy makers' awareness of the importance of research and to make valuable contributions to the fundamental changes which have taken place in the Dutch innovation system in the last years. This is illustrated by the success of Private-Public Partnerships, for example of the 'leading Technology Institutes' programme. A recent OECD peer review of this programme concluded that "…*it is a proven good practice in mobilizing public and private research towards common objectives of high importance for the economy and society*"[124].

However, Private Sector impact seems to be weaker in the sector councils and on the level of research policy implementation, where Private Sector impact is limited to some exposure to strategic decision making, for example through membership in boards, programme committees, etc. There is also some debate whether the Innovation Platform can achieve a maximum leverage without an own 'line of command' and budget, depending on the willingness of other institutions to implement its recommendations.

The need to "*…improve the responsiveness to industry needs of public research organisations, especially universities, through new financing mechanisms, entrepreneurship and improved capability to manage IPRs*", which was criticised by the same OECD study[124], represents another example for limitations of the Private Sector's possibility to stimulate necessary changes.

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123 Financed by annual membership dues, by donations of corporations, foundations and organisations and by subsidies of the Ministry of Economic Affairs and the Ministry of Education, Culture and Science.

124 Source: *Public-Private Partnerships for Research and innovation: An Evaluation of the Dutch Experience*, prepared by the OECD in co-operation with the Dutch Ministry of Economic Affairs and in consultation with other stakeholders.

4. Conclusions and transferability

The elaborate system of advisory bodies with its thoughtful distribution of roles and the deep involvement of Private Sector representatives makes it an interesting option to consider for other countries, in particular for Private Sector involvement in the instigation and design stage of research policy.

However, several factors may be decisive for the possibility of transferring it to other national Innovation Systems:

- *Structure of the National Science and innovation System*
  The described model might be most efficient for well-developed and -performing Innovation Systems with a critical mass. A reasonably high R&D density and existing public and Private Sector research structures must ensure top level membership in the advisory bodies, their 'fuelling' with innovative ideas and their credibility as discussion partners for government to promote research and its importance for national welfare. An additional issue to consider are decision structures: The Dutch research governance system is designed to take decisions and to implement them in a centralised way, where most important decisions are taken at a federal level by ministries which are well connected with advisory bodies, Private Sector representatives and other stakeholders.
- *Investment in advisory*
  Another important element of the described advisory bodies' efficiency is their independence, which relies on their legal status and own support infrastructure. This is only possible if government is willing to make a commitment to establish such a status for an independent institution, over which it has no direct control.
- *Private sector representatives*
  The Dutch model builds to a large extent on contributions from dedicated high level individuals representing their stakeholder groups in the key advisory bodies. The availability and commitment of such individuals is an indispensable key success factor for this model.
- *Cultural background*
  The described advisory model is based on a far reaching willingness of all involved parties to collaborate and to find a consensus despite differences, often referred to as the Dutch 'polder model'. This attitude has a long standing tradition in the Netherlands and finds its expression for example in the organised cooperation between the Dutch government, employers and labour unions, embodied in the Social and Economic Council of the Netherlands (Sociaal Economische Raad, SER), which was established in law already by the 1950 Industrial Organisation Act.

Appendix: Additional important literature and information[125]

Literature

Public-Private Partnerships for Research and innovation: An Evaluation of the Dutch Experience, published by the Organisation for Economic Co-Operation and Development, Paris, 2003

Knowledge for Policy – Policy for Knowledge, Advisory Report 63, published by the Adviesraad voor het Wetenschaps- en Technologiebeleid, May 2005, available from http://www.awt.nl/uploads/files/a63uk.pdf

Time to pick the fruits of the loom - Renewing innovation policy, Advisory Report 59, published by the Adviesraad voor het Wetenschaps- en Technologiebeleid, June 2004, available from http://www.awt.nl/?id=28

Backing winners. From generic technology policy to active innovation policy, Advisory Report 53, published by the Adviesraad voor het Wetenschaps- en Technologiebeleid, July 2003, available from http://www.awt.nl/uploads/files/a53uk.pdf

W. Halffman, R. Hoppe, *Science/policy boundaries: a changing division of labour in Dutch expert policy advice*, in Scientific Expertise and Political Decision Making, edited by Sabine Maasse and Peter Weingart. Dordrecht: Kluwer, 2004, available from http://bbt-webserver.bbt.utwente.nl/rethinking/Downloads/HH_Sci_Pol_Bounds.pdf

Internet sources

http://www.minez.nl	Ministry of Economic Affairs
http://www.minocw.nl	Ministry of Education, Culture and Science
http://www.minocw.nl/cos/english/	Consultative Committee of Sector Councils for research and development (COS)
http://www.awt.nl	AWT (Advisory Council for Science and Technology Policy)
http://www.innovatieplatform.nl/en/index.html	Dutch Innovation Platform
http://www.vno-ncw.nl/	Confederation of Netherlands Industry and Employers (VNO-NCW)

[125] For basic information already quoted, please refer to the country report for The Netherlands in this study.

A5.3 Case study: 'Operation Futuris' – a national foresight study to induce reforms of the French National Science and Innovation System

1. Policy and institutional context

With the emergence of changing research, innovation and industrial policy paradigms, there was a growing concern among policy thought leaders whether the French research and innovation system and its current governance framework needed a fundamental rethink. Would the French Science and Innovation System (which is characterised by one of the highest proportions of public GERD in the EU, combined with highly centralised but at the same time complex governance structures with a multitude of actors) be able to adapt and react efficiently to the challenges of globalisation, changing economic and industrial structures and of meeting the Lisbon and Barcelona objectives?

The status of the French system at this time was summarised later by an OECD study[126]:

> *"Compared with other countries, the French innovation performance is mediocre. French economy and society do not fully benefit from a public research investment which itself is at a relatively high level. Corporate R&D overall lacks dynamism and several indicators provide evidence for a relative decline of the French technology position during the last decade and for the weak drive and capability of many French companies to innovate, in particular of SMEs."*
>
> *This situation can be partially explained by certain long time characteristics of the French National Innovation System which have certainly permitted the country to develop a solid relative advantage in certain sectors (aeronautics, aerospace, nuclear energy, transportation systems) but which today are at the source of problems faced by other sectors in the necessary adaptation to a global economy which is based on new production and knowledge and technology diffusion mechanisms.*
>
> *The French technology policy which was pursued for a long time has led to a strong concentration of research and innovation efforts in large public research organisations and in industrial groupings organised around large enterprises which depend on Government funding and public markets. This has restrained the field for Private Sector initiatives in response to market signals and to emerging demands from society."*

In fact, this status had been documented in various studies[127] and was not unknown to its key actors. There was a widespread conscience among them that reforms were necessary, but had not taken place so far. Previous experiences had also shown that any effort to induce major changes would only be possible if it was based on a broad consensus and on commitment from policy makers, administration, public research, Private Sector and other stakeholders. To achieve this, the stakeholders of the French Science and Innovation System and a broader public had to be sensitised for the actual status and problems and their differing views needed to be aligned.

It was a Private Sector institution, ANRT[128], which took the initiative and proposed a national prospective study towards the end of 2001. Out of this grew the Futuris foresight study, which was launched 2003 with two main objectives:

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[126] Source: Translated from OCDE 2004. For reasons of consistency, French notations used throughout this document where appropriate, for example OCDE instead of English notations ('OECD').

[127] For a policy overview, see for example the Report on Support measures for technological innovation and research (*Mesures de soutien à l'innovation et à la recherche technologique*) published by the Ministère délégué à la Recherche et aux Nouvelles Technologies in 2003

[128] 'Association Nationale de la Recherche Technique', a national 'think tank' which gathers representatives of companies, public research and ministries, supported by French government.

(1) To build a shared vision (on the basis of existing analysis and a review of the situation to be created in the course of the exercise) and to mobilise all national stakeholders.

(2) To make a valuable contribution to the redesign of the system by the responsible policy makers.

Futuris was based on a sound methodological foresight framework and involved over 250 actors, experts and stakeholder representatives. This approach was chosen to achieve four important effects:

- Create a sense of urgency, a high level of awareness of the need for reforms and a shared vision for the future of the French Science and Innovation System.
- Mobilisation of important actor groups, supported by an external 'awakening' of researchers and the public in the course of economic crisis and electoral debates.
- Involve all important stakeholder groups in order to secure their input and a high level of acceptance for and commitment to the results of Futuris.
- Obtain a constructive attitude of all involved parties in the expression of opinions and interests in the course of the exercise.

Backed by a broad consent from policy makers and stakeholders, Futuris was launched in the beginning of 2003 to analyse the major forces and trends influencing the French Science and Innovation System, to identify its strengths and weaknesses, to define scenarios and options for the time horizon until 2020 and to prepare inputs for the reform of the French system by the responsible policymakers. An important underlying issue was the conviction that an initiative dealing with such profound potential changes had to be designed in a way which permitted it to contribute a systemic vision of possible directions and of their driving forces. Only through such an approach the level of acceptance and commitment which was necessary to break the ice and to induce fundamental reorientations could be created. Futuris was designed to build the basis for a general reorientation of French STI policy, while actually leaving the decisions to the responsible decision makers.

2. Detailed description

2.1 History and development of the Futuris initiative

Initially, the project was planned to last 18 months after the conception phase, structured in two phases. It was prolonged to 2½ years with a third phase due to actual political events and to a perception, that going more into depth in certain issues would be necessary, which arose during the study. Therefore four distinct phases can be identified:

Preparatory period (before 2003)

A speech by Mr. Mer, the ANRT president, at the Annual ANRT Dinner, December 4, 2001 ignited the activities leading to Futuris. In this speech, addressed directly to the French Prime Minister and other high level decision makers present at this event, he described the need to develop the French Science and Innovation System beyond its current state and the necessity to create a shared vision among all stakeholders. For this purpose, he proposed a feasibility study which would pave the way for a subsequent 'foresight à la Française'.

This proposal was approved by the government and by the other involved stakeholders. A feasibility study was conducted in 2002 which summarised the current state of the debate in France and explored comparable foresight studies in other countries in a benchmarking to extract lessons for the planned French exercise. As a result, the project plan for the 'Operation Futuris' was proposed and approved.

Phase 1 (January 2003 to April 2004)

The initial decision to base the initiative on a foresight methodology shaped the approach taken. Following the foresight logics, the challenges which the French system was likely to face between 2000 and 2020 were the first analysis focus, rather than limiting the project to a

(backward looking) critical review of the present situation. To be able to look in an unbiased way at a relatively wide range of possibilities, a transversal approach was chosen after an initial review. At the sector level, work was restricted to collecting existing roadmaps or reporting on the absence of such visions, which made it possible to expand on transversal considerations in light of those inputs and to reposition sector issues within a broader context.

The prospective analysis was carried out on two levels:

- Four working groups focused on the issues of excellence, competitiveness, the interaction between research and innovation, and society, and the implications of the French, European, and worldwide political, economic and social environment for the research and innovation system.
- A central team established a network of contacts, including prominent personalities and leading institutions in the field, and worked to draw up the general scenarios based on all the information collected both through networking and through the contributions of the working groups[129].

On this basis, the six scenarios sketched in Figure 1were developed in three stages:

(1) A *preliminary stage*, during which the foundations were developed with a view to answering the initial question: "What are the main areas in which changes will influence the future of the French Science and Innovation System?"

(2) A *scenario building stage* during which the actual scenarios were built up, focusing on a second question: "What are the plausible combinations of changes in the various areas we can use to define plausible outlooks, also relevant for the next 20 years? (This stage aims to select and calculate figures characterising these outlooks)

(3) An *exploratory stage*, during which a third question was examined: "What lessons can be learnt from these analyses?"

The four working groups identified about fifty parameters likely to influence the future of the French system. These were grouped in six categories for analytical purposes: Globalisation dynamics and global challenges, Europe and France in Europe, Science–innovation–society, the roles and modes of intervention of the public authorities, French research and innovation governance and public policy, public research evolutions, Private R&D and innovation evolutions and the attractiveness for such RDI activities localisation. For each component, the team defined three hypothesis of evolution over the next two decades.

Futuris scenarios	
1a	Defensive decline
1b	Opportunistic passivity
2	A wager on national and regional dynamics
3	Ambition for France and Europe
4	Pragmatism in a Europe of regions
5	France: A player in a powerful Europe

Table 1: Scenarios developed during Phase 1 of Futuris

The results of this phase were summarised in a summary report with the provocative title *The French Research and Innovation System - Daring to ask the tough questions, working together to build a future*. To stimulate the desired intensive debate, in addition a large national symposium was held in April 2004.

Phase 2 (May 2004 to December 2004)

In the second phase, the Futuris community which had emerged during the first phase explored the identified key questions and started to explore the important sectors and their interdependence in a series of working groups. Three major objectives guided the work in the second phase: (1) Provision of inputs for the upcoming new research law, (2) understanding

[129] The summary report of Phase 1 states that total consistency between the work at these two levels was not a 'must' to avoid a weakening of the analyses or delays in the publication of the findings.

of factors influencing national R&D investment and (3) the launch of in-depth discussions for priority sectors.

Already during this phase, specific reports were worked out as inputs for further analysis and for actual policy making, for example

- a report summarising elements of findings as input for a national debate in March 2004 (*Futuris: Eléments de synthèse pour un débat national*);
- Questions concerning policy propositions in July 2004 (*Des questions aux propositions*);
- the 'reformoscope', a tool for assessing the possible impact of reforms, October 2004 (*Le Réformoscope: un outil pour mieux voir où nous mènent les propositions de réformes*);
- proposals for a reform of the Research and Innovation System, October 2004 (*Quelques propositions Futuris pour une réforme du système de recherche et d'innovation*)

The results of this phase were summarised in a final paper entitled *The French Research and Innovation System; Proposals for a reform*. It described the French system in the following way: "*…centralised, of limited reactivity and compatibility with the emerging European Research Area, the French National Research and Innovation System does not have today the means to reach its expressed ambitions. A global reform is necessary*." The 15 key thematic priorities of this report were detailed in separate annexes.

Phase 3 (January 2005 to June 2005)

In the third phase, the scope of the in-depth questions explored in working groups was extended in particular towards a sectoral analysis. This work could build on a first series of sectoral studies performed already in Phase 2 and on an external study on the available portfolio of policy instruments for research and innovation support.

But it was decided to refrain from aligning a series of parallel studies on individual sectors because it was feared that this would repeat work already carried out in these sectors and thus would create only a marginal value added. Instead, to avoid this, it was decided to focus on the various relations between important sectors. This induced two work streams:

- A quantitative study had to reveal the contributions of scientific disciplines, sectors and technological areas to the overall French innovation activities and economy[130].
- A qualitative study illustrated the individual sector's challenges, based on a common methodology which was elaborated specifically for this purpose in the course of Futuris.

To ensure that the results were compatible and comparable, the analytical framework described in Figure 1 was used consistently throughout these sectoral studies. It applied always the same seven dimensions for each the overall sector assessment (see figure 1). In the same way, comparable sets of criteria were used for the description of challenges and of the impact of Public Sector policy R&D support measures.

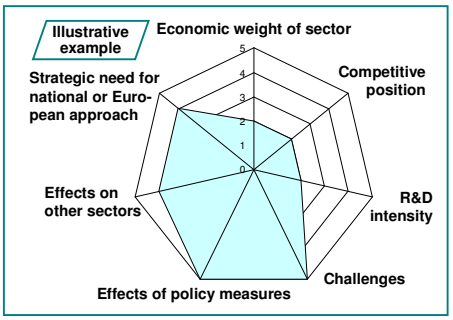

Figure 1: Analytical framework for Futuris sectoral studies[131]

The results of these studies were summarised in a final report, published in November 2005. On this basis, the relevance of policy support measures and other important determinants were discussed.

Overall, Phases 2 and 3 of Futuris went into depth in eight thematic key areas: Sectoral studies, the governance of the French Science and Innovation System, the organisation of Public

[130] See Barre and Charlet, 2005
[131] Source: Futuris publication *Définir les priorités de recherche et d'innovation : Vers un outil adapté aux spécificités sectorielles*, November 2005

Sector research, human resources, Public-Private-Partnerships, attractiveness of France as a research location, the employment of doctors and the development of innovative enterprises. The total of Futuris results now serves as an important input for policy makers in their attempt to reform the French Science and Innovation System.

Finally, it is important to note that from the outset, the Steering Committee stated that the idea was not to make recommendations for specific actions to the public authorities. They assigned Futuris the task of identifying the key issues that decision makers in the French Public or Private Sectors should take into account, with a view to moving the system forward in a direction favourable to French society. However, during the study or at the end of the second round of debates, certain recommendations emerged 'naturally'.

2.2 Process and project organisation

The process followed examples from similar exercises in other countries and was characterised by

- a strong focus on a strategic future-oriented prospective study which relied on existing diagnostics (which existed already in an abundant quantity) instead of putting important resources on new analysis.
- results developed in working groups which involved a large group of over 250 experts and decision makers in total;
- scenarios as key outputs of a non-determining nature, permitting decision makers to draw their own conclusions (received by most decision makers in a positive way).

Another important characteristic of Futuris was that it took an integrative look at the whole system and was kept thematically open in the choice of thematic areas for in-depth analysis. This included an integration of research and innovation issues to avoid a split into two parties with opposing views ("Save research" vs. "Industrial innovation priority"). One of the leading personalities of the initiative, Mr. Lesourne, expressed this in the following way[132]:

> *"The area to explore is vast and complex and includes a multitude of aspects of state policy (and of the larger public community), ranging from research budget issues to fiscal measures to stimulate innovation, from science-oriented educational policy to the general attitude vis-à-vis corporate spirit.*
>
> *Therefore, Futuris is obliged to think about the pertinent field, the French research and innovation system a whole as well as some of its key elements, to change the angel of view permanently, to choose different indicators, to isolate specific problems. But all this must be done in a way which keeps the underlying bigger picture in mind."*

This was implemented in a dedicated and highly professional project organisation which is characterised by four key elements:

- A four layer project organisation, consisting of
  - a high level Steering Committee (*Comité de pilotage*) in charge of providing the necessary political orientation and of validating the findings;
  - a project management committee (*Comité d'orientation*), in charge of following the project evolution and of necessary day-to-day decisions concerning methodology and content questions;
  - a strong and dedicated project team, in charge of project planning, moderation of the working groups, compilation of results of providing the necessary administrative base;

[132] Source: Lesourne 2003

- working groups which were initiated ad hoc for dealing with a specific issue when it arose.

- The independence of the project, ensured by a secured financing[133] and the base provided by ANRT, the institution hosting the project.
- A mode of operation which relied on specialised working groups, moderated by a chairman and supported by a rapporteur who was responsible for documenting the results.
- A lean and efficient project administration which ensured the validation and compilation of individual results as well as the necessary preparatory work, organisation of meetings and public relations.

Communication of Futuris' status and findings was considered as being very important. An Internet platform provided access to detailed information (http://www.futuris-village.org, later also http://www.operation-futuris.org).

3. Impact of Private Sector involvement and effectiveness in leveraging publicly funded RTD/stimulating Private Sector RTD investment

Private Sector involvement in Futuris went beyond what was considered as the typical level in this type of research policy oriented initiative. In particular, the ANRT's contributions and the special role which it took in the process were crucial for success. In the case of Futuris, there were important reasons for proceeding in this way:

- *The Private Sector 'in the driver's seat' in the instigation phase*

  Before Futuris, the need for reforms of the French National Research and Innovation System and of its key elements was sensed by many stakeholders. But attempts of policy makers to induce changes, for example undertaken by the former minister Mr. Allègre in 2001 failed, because there were too diverging views on priorities and directions for reforms. It took the authority of the ANRT as a high level 'spokesman' for the Private Sector and its direct access to the highest level of politics, research/innovation and industrial policy making to instigate this joint initiative.

- *Perseverance and stability*

  The reasons why previous attempts to instigate major reforms had failed include the complexity of the French Research and Innovation System with its vast number of heterogeneous opinions and interests and frequent changes in the political environment. Once the ANRT and – through the ANRT – prominent spokesmen of all involved parties had become fully committed, this provided a continuous driving force which proved to be indispensable as a guarantee for moving forward.

  An example illustrates this: The ANRT's 2001 proposition was addressed to Mr. Jospin, prime minister at this time. But it was his successor, Mr. Raffarin, whose final agreement was needed after the 2002 feasibility study to launch the operation Futuris. Without the ANRT as a guarantee for continuity it is likely that changing political priorities might have altered, delayed or even prevented the stringent Futuris process as it happened under the auspices of the ANRT.

- *Reliable and efficient Futuris platform*

  ANRT and several companies co-financed Futuris. In addition, ANRT hosted also the Futuris organisation and supported the initiative in various ways. A special merit is to have done this in a way which guaranteed a truly neutral organisational platform, recognised as such by all parties. The Futuris Evaluation Report states that *"…Futuris has been a space for encounter, not tied to established institutions, which built its own legitimation by*

[133] Futuris was co-financed by the ANRT, the ministries of research and of industry and by industry donations. The overall budget was approximately 2.5 Million. Euros.

surpassing the immediate interests of its promoters. Personalities – speaking for themselves – though associated with one of the involved sectors, got engaged in the initiative. The basis for this encounter has been the prospective study".

- *Credibility and commitment*

  ANRT's recognised authority and visible leading role in the Futuris initiative was also instrumental in securing the full commitment of key actors (who were involved as individuals, not as representatives of their organisations, in accordance with the Futuris operating principles). One of our interviewees confirmed this: "*…Very often high level decision makers send other people to replace them in such committee meetings. This did almost not happen in Futuris"*.

Phase 3 of the described Futuris process has only been concluded recently and major reforms are still under way at this point in time. Therefore, it is too early for a final assessment og Futuris' leverage in terms of Private Sector RTD investment achieved through publicly funded RTD. However, it can be stated already today that Futuris has enabled a dialogue between the different actors of the French Research and Innovation System which was not possible before (One of our interviewees commented: "We spent the first months in the working groups fighting, until we learned to develop a common language and to listen to each other..".). As a consequence, it is likely that the necessary reorientation of the traditional French industry structures towards new, high growth sectors, networked research and innovation processes with lean, flexible actors, etc. might become smoother and faster.

4. Conclusions and transferability

The evaluation of Futuris, published in December 2005[134], summarised its findings in two conclusions:

(1) Futuris has been a success.

(2) The process initiated by Futuris must be continued.

Futuris has four important merits: The generation of a reference framework as basis for cooperative analysis, the reinforcement of the link between research and innovation, valuable prospective analysis as a reliable basis for discussion and scenario development and a high level of awareness among stakeholders and public. The evaluation attributes this success to the quality of moderation, appropriate financial support, efficient and lean process management and the assembly of a large, representative portfolio of participants. Futuris offered a unique platform for debate and analysis, involving a multitude of public and private research and innovation actors. This was the first time that a foresight exercise of this strategic dimension with a systemic approach took place in France. But it was also stated that "… the construction site is far from being completed."

In a detailed view, the evaluation identified three major challenges which Futuris was facing:

- Before Futuris, the legitimation of such a project was usually provided by the state authorities. The absence of the government authorities as the 'natural' driver and process owner has enabled a broad commitment, motivated by the perception of a neutral process with a real opportunity to influence it. But this has also required an extra effort for the project to find its own identity, thus slowing down the process as a whole to some extent.
- The identification of variables which explain the status of the French National Research and Innovation System and its reform options was a delicate choice. In its initial phase, the project dealt with a multitude of external influencing factors, but had a tendency to circumvent some of the inherent factors, related for example to the structure of the governmental research governance structures and the role of their key institutions.

[134] *Rapport du Comité d'Évaluation, Evaluation Report*, December 2005

- The choice of the level of analysis imposed trade-offs and was not maintained consequently during the exercise. This concerned especially the initial decision to focus on global and thematic issues and not on a sectoral analysis which was not followed consequently during the process (Even if there were reasons which justified this modification). This became very demanding for managing the process and integrating the results.

In addition, three important elements were not represented in the process to the desirable extent. (1) A stronger European and international dimension would have avoided a certain 'inward looking' perspective. (2) The regional perspective (which happens to play a key role in many modern innovation processes, e.g. in clusters) was underrepresented. (3) A stronger participation of some important stakeholder groups could have contributed to a more balanced view (SME; tertiary sector, workers' unions, financial administration, journalists)

Concerning the process, the evaluation stated that "*…it would be dangerous to envisage a prolongation of the experience in its present form. In other terms, the duration of Futuris – with the means and methods it has – has been taken to the possible maximum*".

For the future, the evaluation recommends that the common space created in Futuris should be maintained as a 'think tank' or platform for discussion, benchmarking and in-depth analysis, accompanying the overall change process of the French Research and Innovation System. It is proposed that the ANRT maintains its engagement and takes the Futuris initiative to a next step: "*The construction site opened in 2001 is far from being terminated. The national landscape is at the dawn of a probable renewal which requires a close observation, benchmarking and going into depth. At this level, the state is assuming his responsibilities. Bit its role has changed and the Private Sector actors must assume theirs.*"

To do this, three options are possible: The continuation in the current constellation hosted by ANRT, a more autonomous status, still hosted by ANRT but involving other partners, or a position as a cooperative platform for prospective studies, independent from ANRT hosting.

The described process provides important lessons and may make it to some extent a model for other countries, aspiring to undertake similar exercises to mobilise their structures and actors. However, the particular French situation has shaped Futuris' particular approach. This may require adaptations.

Appendix A: Additional important literature and information[135]

Literature

Papers published by the Futuris initiative:

a. Papon, P., Bellon, B., Krull, W., Rip, A., Thoenig, J.-C., Rapport du Comité d'Évaluation, Evaluation Report, December 2005
b. *Définir les priorités de recherche et d'innovation: Vers un outil adapté aux spécificités sectorielles*, November 2005
c. Barre, R., Charlet, V., *Vers un outil quantitatif d'analyse sectorielle du système français de recherche et d'innovation*, April 2005
d. *The French Research and Innovation System - Daring to ask the tough questions, working together to build a future*, Synthesis report, March 2004
e. *Le système français de recherche et d'innovation*, February 2004
f. Lesourne, J., *Futuris – Pourquoi et comment*, discussion paper, 2003

Organisation de Coopération et de Développement Économiques (OCDE), *Les partenariats public-privé pour la recherche et l'innovation : Une évaluation de l'expérience française*, OCDE, Paris, 2004

Mesures de soutien à l'innovation et à la recherche technologique ; Bilan au 31 décembre 2002, Report published by the Ministère délégué à la Recherche et aux Nouvelles Technologies, Direction de la technologie, April 2003

Speech of the ANRT president, Mr. F. Mer at the Annual ANRT Dinner, December 4, 2001, available from http://www.anrt.asso.fr/fr/association/dejeuner_annuel_ancien.jsp?index=1

Internet sources

http://www.anrt.asso.fr/index.jsp	Homepage of the Association Nationale de la Recherche Technique
http://www.operation-futuris.org/	New Futuris Homepage
http://www.futuris-village.org/	First Futuris Homepage
http://cip-etats-generaux.apinc.org/article.php3?id_article=25	Additional overview over Futuris publications
http://www.recherche.gouv.fr/concertation/demarche.htm	Internet site of the *Ministère délégué à la Recherche et aux Nouvelles Technologies*, dedicated to Futuris and related issues

[135] For basic information already quoted, please refer to the country report France in this study.

A5.4 Case study: COTEC Portugal

1. Policy and institutional context and development of *COTEC*

The launch of COTEC[136] Portugal on April 29, 2003, as an enterprise association with a single emphasis on promoting innovation in Portugal, was in itself an innovative event in the Portuguese landscape. At that time, Portugal was lagging behind most EU countries in its innovation performance. It was experiencing a general economic slowdown and the overall business environment was not attracting major new investments. The historically grown dominance of low-tech sectors in Portugal's industrial and economic structure and a limited commitment to science and innovation of society as a whole - and of Portuguese companies in particular - were seen as a major barrier (Simões, 2003). There was no clear and comprehensive national innovation policy framework to coordinate related policy initiatives of various governmental programmes and agencies and to strengthen other stakeholders' commitment to research and innovation. This was reflected in a poor research and innovation performance, confirmed for example by the results of the European Innovation Scoreboard (EC, 2001. Portuguese policy could not stimulate the necessary strong commitment of Private Sector enterprises to research and innovation.

As the main national source of research funding, Portuguese research policy focussed on funding research[137] in universities, which house the majority of Portuguese researchers. Other target areas include advanced training and – with the support of European Structural Funds – the internationalisation of Portuguese research. The Private Sector's share remained at a moderate level of approximately one third of national research expenditure, despite several specific initiatives to stimulate enhanced private Sector R&D (OCES, 2005).

While the performance of Portuguese higher education institutions and research institutes grew steadily, they had little impact on the level of competitiveness of the Portuguese economy and of its companies. Commercial firms did not exploit the generated scientific knowledge to the desired extent and convert it to industrial innovation. Knowledge and technology transfer to Private Sector entities remained also limited, even if several new interface organisations had emerged in recent years, involving academic researchers and industrial partners. Alliances between universities and Private Sector companies grew, but they had little visible and measurable success. Measures specifically dedicated to support Private Sector innovation activities encountered limited demand and had no major impact. Other mechanisms to fuel innovation, e.g. the presence of seed and venture capital funding for start-ups in Portugal were also still in an infancy state. Despite this, the R&D performance of Portugal's business enterprise sector grew, but remained restricted to a small number of firms.

In view of these challenges and of the financial constraints imposed by the requirements of the European Growth and Stability Pact and a general economic slowdown, the Portuguese government introduced the Programme for Productivity and Economic Growth (PPCE) in 2002. The PPCE and its accompanying sub-programmes set up a host of measures to provide a suitable framework for stimulating Private Sector research and innovation investment. However, the attractiveness of these stimuli was not widely recognized; partly due to the conservative attitude of traditional business sectors, partly due to overall pessimism of Private Sector firms and the general public.

As a consequence, there was a widespread growing recognition that the country needed a new model for competitiveness, based on knowledge and innovation. The Private Sector therefore needed an initiative, from within, which would help promote the importance of innovation among businesses and to align the dispersed Private Sector vis-à-vis government research and innovation policies. The only group which had the necessary resources, con-

136 The name COTEC was adopted from its Italian and Spanish counterparts, which inspired the Portuguese COTEC model.

137 Source: COTEC systemic approach 2005; for details see the country profile Portugal of this report.

science and political weight to undertake such an initiative were the country's large, research intensive industrial companies. At the same time, this was also the group which felt the most urgent need for such a new model of competitiveness. Inspired by existing associations in Europe (COTEC Spain and COTEC Italy) a discourse among the leaders of these companies started to emerge towards the beginning of the decade. But the idea was not taken further until a match between their needs and the growing interest of the country's President, Mr. Jorge Sampaio occurred.

The Portuguese President perceived research and innovation as key drivers for the country's further economic progress. Therefore he had launched already himself several initiatives in support of research and innovation. In 2000 he convened a seminar for business, academic and government representatives to discuss innovation issues and barriers in Portugal. Later, a book with the seminar's results was published. Mr. Sampaio put research and innovation on the front line of his political agenda and was keen on spreading the idea further in business circles. He was therefore the obvious high level political proponent who could give the highest profile to such a new initiative. In addition, he also endorsed the idea that the Private Sector should take the lead role in inducing necessary change, namely through some of its largest and most dynamic firms.

COTEC was launched as a business association in April 2003 at the Innovation Week, an event to promote innovation excellence organized by the President himself. He took the patronage of COTEC. And since then, the President's authority has been embedded in COTEC and its constitutional charter as an essential element of the whole arrangement. The President is not only a mediator between COTEC's (business objective driven) principles, policy makers, public research and higher education. He acts also as a catalyst, stimulating discussion within the association and between COTEC and other stakeholders. And his personal commitment and public recognition support the necessary credibility of COTEC as the 'voice of the economy' in questions of research and innovation vis-à-vis the Public Sector, other stakeholders and the public. This has also been very helpful to attract new members since the foundation of COTEC.

COTEC's founding members encompass many of Portugal's largest companies and include Portugal's main business R&D performers. Their conviction that Portugal's innovation culture and R&D investment had to be enhanced and spread to a larger sample of actors was essential for their own commitment and for reaching a consensus on COTEC's three major strategic themes:

- *The promotion of a culture of innovation* across the economy. Research and innovation should be recognized as a main source of competitiveness.
- *Fostering the practice of research and innovation* by all entities within the Portuguese innovation system. Successful and efficient research and innovation processes should serve as examples, stimulating their further dissemination and R&D investment by other enterprises.
- *Influencing the strategic orientation of the relevant research and innovation systems* in Portugal, but also in Europe. Research and innovation policies should be shaped in a way which ensures more relevance and leverage for the economy.

The first objective has visibly been achieved through COTEC's wider impact. And COTEC has made important contributions to progress achieved on the remaining objectives, for example to the definition of extended and more ambitious strategic objectives for the Portuguese research and innovation system (e.g. contributing to the National Innovation Plan[138]) and to specific legislation (consulted during the preparation of relevant legislation regarding doctoral fellowships in firms - BDEs).

[138] Even if this was not implemented due to changes in the government.

The strategic approach to achieve these objectives focuses on the attempt to bridge the gap between knowledge generation and its commercial application. Carefully planned, aimed and executed thematic initiatives, broken down into precisely defined projects are used as the key instrument. They are accompanied by other measures which aim at creating awareness, involvement and commitment. The leaders of COTEC recognise that knowledge and experience are needed to solve some of Portuguese society's ailing issues already exist. With relatively little additional funding, with good project management and an extensive network of cooperating firms, they aim to exploit this knowledge and experience to address problems which traditional policies and approaches failed to solve. It is hoped that addressing problems which are specific, but not unique, for Portugal, creates spin-off effects through (1) the use of project results and of expertise gained to create new competitive edge in a larger context, (2) involvement of more actors from the business community in innovation activities, and (3) accelerated dissemination of the practice of research and innovation.

To constitute and establish the new association successfully, three important key success factors were recognised early:

- *Independence from Public Sector influence*

  This could only be achieved by self-financing, pursuit of own themes and topics and a clear positioning of COTEC as 'business-only' organization. However, independence as an operating principle does and should not exclude intensive cooperation with Public Sector bodies, because they and COTEC are ultimately working towards common objectives and a shared vision of a performing Portuguese Research and Innovation System.

- *Participation of a critical mass of committed and networked companies*

  Participants are expected to be much more active than paying their membership fees. Their strong intrinsic motivation to participate in COTEC initiatives must stem from a win-win situation, where they see also advantages for themselves from active participation of their employees in initiatives, from discussion, information and networking events, etc.

- *Operational efficiency*

  The COTEC organisation should be kept lean to keep it flexible and to control the cost of administration. As a result, the COTEC association consists until today of less than 10 permanent employees. These coordinate and support the association's activities and communication among members and partners.

Since its conception, COTEC has experienced some changes in membership. Joining new members (but also the leave of some members) have led to a total of currently 106 members. Nevertheless, COTEC's members encompass most of the top 100 Portuguese firms, representing approximately 20% of Portuguese GDP.

An expansion of COTEC's reach into a different direction comes now from a strategic reorientation: During the initial phase of COTEC, it was believed that large firms have to be the back bones of the organisation to ensure stability, to implement decisions with strong partner commitment and to provide the necessary visibility. Only they were thought to have the necessary resources, people, leverage and pool of knowledge for this. This notion proved true in the start-up phase of COTEC. However, since June 2005 a slight change occurs. COTEC undertakes now a conscious effort to attract innovative SME's as a new target group, for example by waiving their fees. There are currently 24 members of COTEC's innovative SME network, with more expected to be invited.

2. Detailed description

2.1 Activities of COTEC

Since its conception, COTEC has embarked on a number of different activities to reach the objectives set by its founders and members. These can be classified roughly in two types: (1) Activities to create awareness and to promote research and innovation and (2) specific pro-

jects to contribute to the solution of actual problems of the Portuguese society by demonstrating the value of research and innovation contributions. In both approaches work is usually organized in a working group or project arrangement. Typically, the basis is provided by a combination of the expertise, resources, managerial skills, know-how and contacts of several COTEC associates who volunteer to be part of the specific initiative. A designated COTEC manager provides administrative support, operative supervision, etc. as needed.

COTEC's first type of activities aims to create a higher level of awareness of the potential of research and innovation, to disseminate related knowledge and to stimulate communication and collaboration among Portuguese companies in this area. This mission to enhance Private Sector internal interaction is complemented by a set of external communication tasks to represent the common stance of the Portuguese industry vis-à-vis external institutions and stakeholders and to reinforce the position of COTEC within the Portuguese Research and Innovation System. Initiatives in this area include for example the COTEC annual meeting, the COTEC Innovation Award, an Innovation Portal, etc. These are also helpful the foster the discourse among COTEC associates and to get non-members interested and involved.

The second type of COTEC activities is represented by projects which target specific issues. The intention is to demonstrate the potential of research and innovation based approaches by applying the combined skills and resources of COTEC members in this area to selected major ailing issues of the Portuguese society.

Such projects do not only yield tangible problem solutions. They serve also as showcases for the benefits of research and innovation and as 'training ground' to develop, apply and disseminate specific skills, methods, etc. An example for such a project is COTEC's forest fires initiative. It involved a large number of actors in various sub-projects to develop innovative solutions for an actual problem of Portuguese society, addressing for example the areas of surveying current systems, developing probability modelling software, developing video monitoring systems etc. The result of this joint effort was a series of policy recommendations based on contributions from several experts, and an advanced integrated technology for fire detection, warning and suppression which is expected to be of practical value for Portuguese society in an area of major national concern.

Beyond such projects with a focussed technological output, COTEC initiates and conducts also conceptional projects, e.g. the national logistics concept, technology opportunity studies or the definition of innovation metrics and launches target group-specific initiatives (e.g. COHiTEC, Minho Software Cluster). But most initiatives focus on the application of knowledge to 'real life' problems, in line with COTEC's strategic direction. Figure 1 positions some of COTEC's activities as a function of their practical applicability and the level of involvement.

Since the start of COTEC's activities in 2003, there have been few modifications to this portfolio (called the Action Plan). These were mostly extensions to existing activities. The 2005 action plan expanded for example the COHiTEC Initiative, including its subchapter NPD2005 which provides innovation management lecturing for corporate leaders. To describe innovation processes and their key parameters better, it introduces also innovation standards.

In general, COTEC projects do not work towards direct, tangible benefit of single COTEC members. They are expected to generate a positive cost/benefit relationship, but this is often more the case for Portuguese society or for a specific target group. Benefits are often also of a more indirect nature, for example in the form of enhanced project management skills, of networking with other companies, access to new sources of technology and innovation, knowledge transfer or strategy realignment acquired in the project. Even if such benefits are difficult to quantify in terms of a measurable cost/benefit ratio, their indirect and long term benefit is appreciated. COTEC is convinced that by promotion of R&D, innovation and technological advance across the whole economy, spill-over effects will be created. Ultimately, jointly created new innovation opportunities, an enhanced portfolio of potential partners, a better business and innovation environment, and other COTEC results will also benefit its members in the longer run.

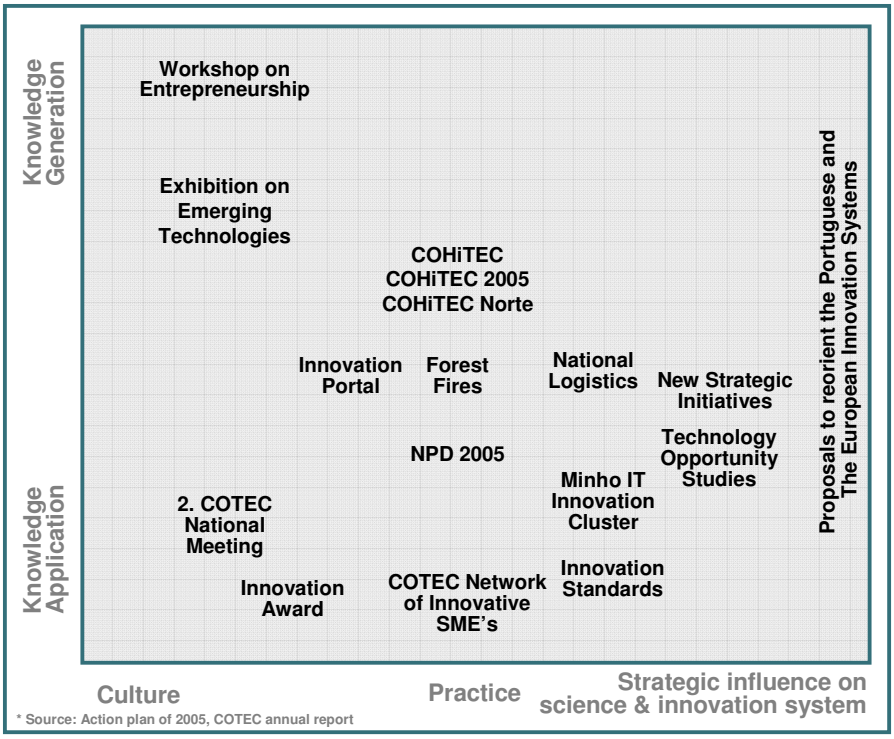

Figure 1: Representative COTEC activities[139]

COHiTEC is probably one of the best examples of a successful COTEC activity. Realised in 2004 in cooperation with the Luso-American Foundation (FLAD) and the HiTEC Centre of North Carolina State University (NCSU), this initiative was designed to disseminate methodologies for the translation of existing technical knowledge into value generating problem solutions. The initiative has been realized in two tiers: (1) The TEC programme, working with a target group of academic researchers and MBA students from leading universities and (2) the NPD programme aiming at COTEC associate members.

The TEC module focuses on demonstrating ways to transfer generated or existing scientific and technological knowledge at universities to concrete business ideas. The core of the NPD module was a one week training programme on new product development and innovation management for representatives of 35 COTEC members. This initiative has encountered a wide interest of all groups of stakeholders, including state policy makers. COTEC's initiative helped participants and observers to become aware of the gap between knowledge generation and its application and of the potential of hi-tech, high growth companies. The resulting extended skill base and complementary advice from involved researchers have contributed to the development or reinforcement of participants' innovation skills and activities. In some cases the initiation of hi-tech start-ups was stimulated also. Because of the initial success, COHiTEC has already been extended to its second iteration in the northern regions of Portugal. Because of its complementary with publicly financed programmes, policy makers and public agencies also recognize the importance of COHiTEC.

To achieve more leverage, the TEC module selects a relatively small number of business plans and then provides intensive support for these to help them become success stories which stimulate similar activities and from which lessons learned can be drawn and transferred to other potential start-ups. Business plans in the current 'wave' include different innovative ideas in food, optics, chemistry, IT, optics etc. (Problad, BioInova, T-lenses, Cynara, Cleanall, GLiNt Systems, Olidrox).

139 Source: *Cotec Portugal - Relatório e Contas*, Exercício de 2004

As the result of a recent reconsideration of its strategy, COTEC is now taking the initiative to gradually include SMEs in its activities and to extend its range of activities and services to address their specific needs. There are three important reasons for this: (1) Research and innovation are believed to be of an equal critical importance for SME's in specific sectors. (2) The gap between current status and desirable innovation performance and the need for an enhanced promotion of innovation culture and entrepreneurship may be even more important for SMEs. (3) Experiences from other countries suggest that there is a 'win-win' for large firms, SME's and start-ups if they interact efficiently in networks, R&D co-operations, clusters, etc., where each of them makes specific contributions to integrated, seamless innovation processes.

Therefore COTEC decided to launch a **network of innovative SME's** and the **SME innovation Prize**. 24 firms with proven innovation achievements and potential were selected by a panel of 'referees'for membership on the basis of applications from interested firms. They are meant to provide an example for the wider community of SME's (like the 2005 Innovation Prize winner Chipidea). And it is also hoped that they will become forerunners in the development of R&D based partnerships with larger companies and in the integration of start-ups and SMEs in emerging innovation clusters.

2.2 COTEC organisational and governance framework

To be efficient, COTEC was set-up as a very lean organization, with a minimum of own resources. COTEC projects draw heavily on members' resource and skill base. COTEC's own staff of less than 10 persons is based in its headquarters in Porto and a representative office in Lisbon. The reasons for this geographical spread are the proximity to major economic and academic centres and the possibility to serve as hubs or 'service centres' for COTEC's activities in the northern and southern regions of Portugal.

COTEC has been established as an enterprise association with the status of an own legal entity. Its operation abides by its constitutional charter, which, however, does not state that membership is limited to companies. Members have only to be legal persons with activities in Portugal and with a clear and direct link to research and innovation. This potential openness gives the association the opportunity to extend its member base to other contributing groups if this becomes appropriate in the future[140].

The governance of COTEC consists of 5 important internal institutions:

- The *General Assembly* represents the members of the association. It is chaired by the President of the Republic of Portugal[141].
- The *Board* is made up of five high level representatives (CEO's) of the largest COTEC members. This group provides guidance for COTEC's long term strategic orientation.
- The *General Council*, follows COTEC's activities more closely and provides advice on issues of strategic importance. It consists of a larger number of members, between 15 and 35
- The *Consultative Board* consists of different invited representatives of the national research and innovation system. It provides a forum for the discussion of issues with importance for COTEC and supports consensus building. It is less decision oriented than the other boards and has a broader orientation, including a continuous dialogue.

[140] Membership is granted by the agreement of the General Assembly where each associate member has one vote. Membership can be of two types: (1) ordinary, or (2) honorary. Honorary members are proposed by the Board to the General Assembly and do not have to be legal entities. For instance, the Portuguese president belongs to this group.

[141] As described earlier, the President's personal involvement has been very intense and supportive in the launch of COTEC. His involvement represents a strong and highly visible commitment and strong signal to members and the larger public.

- The *Statutory Audit Committee* has been formed to provide semi-independent review of the COTEC functioning and resource utilization, in particular of the use of the membership fees levied by COTEC.

The General Council, positioned at an intermediate level between the Board and the General Assembly has the important role of strengthening the network and of sharing strategic decisions with direct impact on implementation by COTEC and its members. But it adds also an additional layer in the governance model. This weakens to some extent the General Assembly and adds additional complexity. On the other hand, the Consultative Board has proven to be more effectively in acquiring valuable external contributions.

COTEC's operational costs are covered by membership fees. Individual projects are usually not financed from this budget but separately through direct contributions from involved members. Project budgets and contributions are agreed in advance and a budget controlling ensures its appropriate utilisation. Contributions are often also of a non-monetary nature, for example in the form of staff man-days, equipment made available for projects, etc. Only in selected cases where this is justified (e.g. at conferences, workshops or board sessions), COTEC participates directly in the costs from its regular budget.

2.3 COTEC at work

In difference with comparable European associations (e.g. COTEC Spain or Italy), COTEC Portugal emphasises a very business-like, result oriented mode of operation. The aim is to promote innovation not only through instruments like studies or seminars, but most importantly through 'real life' examples and usable solutions for selected topics. To secure the success of this mode of operation, topics for exploration are carefully selected. Project management is closely monitored by some of the country's most successful businessmen and results are always carefully evaluated. Moreover, the direct involvement of COTEC members and associates ensures their direct commitment to make each project a success, irrespective of whether they are the direct beneficiaries or if the benefit goes mostly to society as a whole.

A range of key process elements ensure efficient selection and execution of projects:

- *Identification of topics*

  COTEC uses a number of instruments and the collective knowledge of its network to identify topics for further exploration. To generate ideas, COTEC initiates brainstorming sessions and workshops, surveys and own studies. Complementary multi layer discussions among members and associates take place. Major criteria for pinpointing potential priority topics include their potential to provide innovative solutions for the benefit of Portuguese society, the potential to exploit existing knowledge or to generate new knowledge, the probability of success or the relevance of projects for COTEC members and Portuguese society.

- *Selection of topics for initiatives*

  Pre-selected topics are short-listed and prioritized. Pre-selection takes place in a more intensive general discussion on an informal level at various occasions. Final selection of projects to be added to the existing COTEC action programme is a more formal process in which selection criteria similar to those described in the previous paragraph are applied. Final decisions are taken by the Board.

- *Coordination and support by COTEC*

  As a part of the decision to launch a new initiative, potential participants and contributors from COTEC's membership base are identified and their commitment is solicited. To keep the project lean and efficient, this is usually restricted to a limited number of companies which have relevant experience and resources. COTEC's own staff contributes coordination, controlling and project related service skills and capacities.

- *Project management*

  Each selected initiative is managed by an appointed project manager. This project manager is usually delegated from a participating COTEC member. Project activities enjoy typically a certain degree of independence, but are reviewed regularly.

- *Progress reports*

  Progress of all COTEC activities is monitored thoroughly, using regular progress reviews. Annual and bi-annual evaluations complement this procedure to ensure the efficiency and effectiveness of COTEC's overall portfolio of activities.

2.4 Key success factors and observations

The successful launch of COTEC stems to a large extent from the following key factors:

- *Strong COTEC membership base*

  The founding members, and also the majority of other current members are Private Sector enterprises with a strong commitment to innovation. The possibility to draw on this pool of know-how and resources, together with their active backing of COTEC's activities was instrumental for the success of COTEC and for the attraction of new members. According to current thinking, this core should be maintained to avoid a dilution of the competency base or dispersion into too many under critical sub-clusters of specialised competencies and interests.

- *Permanent communication*

  COTEC members interact in multi-modal communication. Members show commitment for example through the assignment of a COTEC spearhead in their organisation. This person acts as the major internal contact for COTEC and for other members, coordinates COTEC related activities, disseminates COTEC information and promotes COTEC among his peers. These COTEC member representatives meet often to communicate on various issues and to build and maintain their network.

- *Public visibility*

  To attract members and to gain public recognition, COTEC had to communicate its importance and contributions to the business sector, to government officials and to a larger public audience. Besides COTEC's own public relation work, President Sampaio's commitment was very helpful to achieve this. Following the example of other COTEC associations (Italy and Spain), the president's authority attracted the press as well as the interest of non-members and the public.

- *Focus*

  To make the best possible use of its limited resources, COTEC prefers a focused portfolio of a limited number of activities which are pursued strictly independent from each other and in a stepwise approach with clearly defined milestones. COTEC applies a very thorough selection process to choose such events, initiatives and actions and limits their overall number. Selection is based on a clear shared understanding of how they contribute to achieving COTEC's goals.

- *Efficient project execution*

  To secure the best use of the limited resources which COTEC and its members can allocate to projects and to maximise leverage from this, a limited number of participants with the best available skills, a visible commitment and non-contradicting interest is summoned for each project. From this group, one member is assigned responsibility for project management. The project team is responsible for the efficient execution of its tasks and for the documentation of lessons learned and skills obtained, which are one of the rewards for the participants.

3. Impact of private sector involvement and effectiveness in leveraging publicly funded RTD/stimulating private sector RTD investment

The European Trend Chart on Innovation[142] confirms that Portugal has caught up especially in the areas of knowledge transfer and application (compared to knowledge creation related fields). Of course, this does not have to mean an exclusive causality, but at least it proves that COTEC is tackling the right issues.

Less than three years after its foundation, it is maybe still too early to evaluate COTEC's impact in a final form. But already now it is visible that COTEC has made and is making important contributions to the development of the Portuguese Research and Innovation System:

- The awareness of the value and importance of research and innovation in the Portuguese economy and society has increased.[143] A change towards a more proactive attitude of many actors can be observed and their research and innovation related skill base is growing. There has also been growing number of initiatives from different sectors and enterprises to support innovation, for example through 'Innovation Prizes'.
- COTEC's projects have been successfully implemented. They have involved a multitude of members and improved their networking in innovation related activities. The projects have also triggered new technology based approaches to some of Portugal's challenges and stimulated similar activities by other actors. Thus, research and innovation have been promoted successfully as a way to build competitive advantage.
- COTEC has established itself as the 'spokesman' of Private Sector enterprises in research and innovation issues and as a partner for public sector policy makers with a high level of recognition and acceptance. As an active stakeholder, COTEC participates also increasingly in Public Sector decision processes to stimulate research and innovation or to develop the Portuguese Research and Innovation System [144].
- At the same time, COTEC's initiatives, visibility and membership, have helped COTEC to promote research and innovation among wider business circles.

From an internal perspective, the strong links and working relationships created among COTEC members are an important asset in itself. Even if some conflicting views on COTEC's strategy remain, member companies have been able to learn to overcome conflicting interests and to work together in an open and constructive spirit for the shared benefit of strengthening their innovation performance. However, this part of COTEC's positive impact is centred on its members, although its activities involve also external partners. But to maintain its current internal efficiency, COTEC wants to maintain its current order of size.

A consequence of this partially self limited growth is that COTEC still has 'open construction sites'. For example, one of COTEC's initial goals was to build bridges to research and innovation systems on the European level. In times of globalisation of markets and research, partnering with similar organizations across Europe and a stronger integration in the European Research Era can be a critical prerequisite for sustainable success. But due to its other priorities and its limited capacities, COTEC has not been able to be so active on this front.

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142 Recent data show that Portuguese firms are gradually becoming more active in research and innovation, one of the main objectives of COTEC. The country's business participation in R&D has been rising in recent years, although the latest data invert this trend (See Trend Chart country reports, 2003, 2004, 2005 and OCES 2005).

143 Trend Chart country report, 2004-2005

144 For example, COTEC representatives and board members are invited to consultations and to provide advice to policymakers, albeit on informal basis. Such interaction took place in the course of preparation of some recent legislation, e.g. for intellectual property and taxation.

4 Conclusions and transferability

At a first glance, COTEC Portugal is an example for a Private Sector led initiative which instigated and drives necessary changes without considerable intervention from the Public Sector side. COTEC exerts considerable influence on Portugal's research and innovation system and on its policy and governance framework through the awareness it creates, the examples it provides and the pool of knowledge it makes available. As such, COTEC can serve as an example for how the Private Sector influences Public Sector research and innovation policy not so much through elaborate concepts, negotiation and communication but rather through pragmatic own action and initiative.

COTEC's ambition is not to become a substantial part of research and innovation policy decision making or to influence Public funding decisions. Nor does it aspire to extend its activities to large scale operations which compete with public research or knowledge transfer institutions. However through its initiative, the examples it provides and the weight of its members' and own statements, COTEC exerts a considerable influence. Considering COTEC's objectives and resource base, this is an appropriate attitude. However, this means also that COTEC does not fill the existing gap in Private Sector involvement in public research policy decision making[145].

Therefore, the use of COTEC Portugal as a model for similar initiatives in other countries may require careful consideration. The substantial modifications which were already necessary when the Italian and Spanish COTEC concept was adapted for Portugal show that there is no 'one fits all' solution. When considering the transferability of this approach to other countries, Portugal's special conditions at the time of the foundation of COTEC have to be considered:

- The size of the Portuguese economy and the limited number of research intensive corporations supported this consensus among a small, dedicated group of actors. Even more important, the founders of COTEC did not have to be convinced. They were already fully aware of the need to act. This helped to create a consensus on the objectives and guidelines rapidly.
- COTEC could only build its position and reputation so rapidly because it filled an existing gap. Even today, it does not compete with other important Private Sector associations in its role as Private Sector 'spokesman' in research and innovation questions. The limited Public Sector policy activities in the Private Sector research arena also left enough space for COTEC to establish its own initiatives and to build its reputation as the driving force for promoting research and innovation.
- President Sampaio's full commitment was vital for COTEC's development. Continuity in this privileged relationship was ensured, providing a strong backing of the Private Sector's initiative.

[145] It should be noted that even today there is no other association contesting which could contest COTEC's position as the industry's voice in research and innovation policy issues.

Appendix: Selected relevant sources and literature[146]

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http://www.inteli.pt/site/resources/docs/eventos/NortinovATICE_CP/NortinovATICE_Conclusions.PDF	Executive summary of the Nortinov Programme (Dec. 2004)
http://pascal.iseg.utl.pt/~cisep/IES/Archive/ies6.pdf	CISEP Newsletter, Apr/May 2003: Foreword

[146] For basic information already quoted, please refer to the country report for Portugal in this study.

A5.5 Case study: The Cambridge (UK) cluster - Public and Private Sector interaction in a liberal environment

1. Policy and institutional context

The Cambridge region has often been quoted as a showcase example of a successful high technology business cluster that has emerged with a leading university at its centre[147]. Indeed, the number of high-tech companies in the Cambridge region has grown from about 20 in 1978 to an impressive number of over 1,500 high technology businesses either locally grown, or inwardly invested, employing in total around 44,000 people[148]. Originally springing from university research, the 'Cambridge Phenomenon' represents today an impressive cluster of research facilities, start-ups and technology driven companies.

Notably, this development of the 'third mission' of a Higher Education Institution, the integration of an economic development effect with the traditional university activities of scholarship, research and teaching, is not primarily the result of a dedicated policy effort. It has rather grown organically under the influence of a powerful combination of the initiative of its key actors and a liberal though supportive policy environment. Cambridge university and other higher education and research organisations have played a key role in this process as major sources of founders of high-tech firms and by attracting large corporations to the area. These have set up research units in and around Cambridge, or entered collaborations with high profile academic research groups. As a result, a large number of regionally active young, small, independent and indigenous companies in high technology sectors and a wealth of cooperation activities between academic research and industry have emerged.

Our interviews confirmed that the primary driving force of this development are not central government or university policy measures which intervened massively to stimulate spin-offs, partnerships or the acquisition of research contracts. Instead, the individual initiative of colleges, faculties, researchers and founders and of their Private Sector counterparts and their 'spontaneous' interaction and collaboration in a favourable environment has been instrumental in creating a very high degree of auto dynamism.

Academic staff has made extensive use of its relative freedom to have links to industry and retain intellectual property rights to work. At the same time, technology companies, private investors and other actors have developed an unusual degree of commitment to be part of Cambridge's local scientific and economic community for reasons which will be explained in the following chapters. In this climate, a rich spectrum of approaches to collaboration with the Private Sector has emerged, depending on the initiative and preferences of academic staff and the Private Sector actors' interests. These range from the traditional forms of contract research, licensing, etc. to innovative forms of intensive research collaboration.

The presence of a strong university-external business community and its high motivation to invest in network building and trustful relations with the academic community is crucial for success. As the enabler of intensive communication and collaboration, a unique set of local networks provide direct access to knowledge and support from a multitude of participants. These networks connect academic and corporate researchers and link them to other important contributors, e.g. venture capital firms, technology consultancies or providers of services for start-up activities. This liberal and stimulating environment is a fertile ground for the foundation of highly innovative technology partnerships, spin-off companies, etc.

This combination of 'technology push' and 'market pull' creates a highly dynamic engine for the creation of business ideas and start-up companies and of research collaborations which is self-starting and self-motivating, without being centrally planned or governed.

[147] The Cambridge region encompasses three higher education institutes: University of Cambridge (>15,000 students), Anglia Ruskin University (approx. 24,000 students, strong vocational focus), Open University (>16,000 students, emphasis on undergraduate and part-time education).

[148] Source: Minshall 2005

2. Detailed description

2.1 Historic development, characteristics and role of the Cambridge networked environment

In the Sixties to Eighties, the existing strong scientific and university community encouraged many Cambridge University graduates to stay here and to found a range of high-technology companies (mostly computer-related). This attracted others and related developments and led to the tag of 'Silicon Fen' (due to the similarities with Silicon Valley). As a reaction to this trend, a subcommittee of the Cambridge University Senate was set up in 1967 to consider the planning aspects of the relationship between the University and science-based industry. It recommended a careful relaxation of policies and in particular the establishment of a science park on the edge of Cambridge. As a result, Trinity College founded the country's first Science Park in 1970. The committee's recommendations have guided planning ever since.

Once the 'Cambridge Phenomenon' had reached a critical mass and started to be recognised publicly, its auto dynamic development accelerated further, fuelled by technology companies' investments and highly visible media coverage. For example, in 1985 a book *The Cambridge Phenomenon* traced the emergence of high-tech firms back to the University and the local research community. The 1998 revision of this report stated changes in the Cambridge Phenomenon, based largely around telecommunications and biotechnology. But it criticised also the lack of support from central government to allow growth of high-tech business sector and in particular the lack of infrastructure developments, leading to planning pressures[149]. Other articles, for example a much-quoted 1998 Newsweek article *Where Wired Is a way of life* added to the hype about Silicon Fen, placing it among the ten most important high-profile high-tech centres.

The attraction of leading international technology corporations, e.g. Microsoft's choice of Cambridge as the hub of Microsoft's European operation, became a further key element. Today, a large number of international technology companies have set up research units in and around Cambridge or entered collaborations with high profile academic research groups. For example, high profile companies, including GSK, Hitachi, Toshiba, Unilever, Microsoft, or BP are located in the area, often on University premises. Complementary forms of interaction and collaboration evolved in parallel. For example in biotechnology, momentum came from embedded laboratories of major pharmaceutical companies alongside University departments, from specialist incubators and science parks, and from a significant group of go-ahead independent companies.

New firm spin-outs continue to be an important element with founders coming from both existing high-tech firms and the research community. But an interesting development can be observed as an effect of Private Sector Influence: In 1985, 25% of the high-tech firms in the Cambridge area had a founder originating either from Cambridge University or from a research establishment in the Cambridge area. More recently, as corporate venturing has increased, this proportion has fallen[150].

Another distinctive element of the cluster are providers of advanced business services, including accountants, lawyers, consultants and financiers. Beyond contributing functional expertise, these actors play a vital role in networking and they have become substantial contributors to the success of technology ventures.

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[149] However, changes in the UK research policy framework supported this development in general. In 1985, the termination of the British Technology Group's monopoly on the ownership of intellectual property rights generated by academics provided universities with the right to exploit their own inventions. The 1993 UK Government White Paper *Realising Our Potential: A Strategy for Science, Engineering and Technology* reflected a growing policy interest in innovation from the science base. Since 1998, the government has also introduced a variety of schemes to support HEI spin-off activities (See Minshall 2005 for details).

[150] Source: Minshall 2005

Finance and professional services have greatly increased their scale and focused on the needs of high-tech businesses. All big accounting and consulting companies have significant offices in the city. In addition, there is a very active group of investment companies with roots in the Cambridge community and close ties to its members. These participate as active fully integrated members in the community and can even take own initiative for its development.

The way how such investors which are deeply rooted in Cambridge contribute to shaping its special atmosphere of interaction is illustrated by the example of Dr. Hermann Hauser, the co-founder of Amadeus Capital, one of the most important local venture capital companies[151]. Having obtained a PhD in Physics at the Cavendish Laboratory, Dr. Hauser later became well-known for his part in setting up Acorn, one of the first spectacular start-up successes in Cambridge. Subsequently he participated in the foundation and spinning-out of various technology companies. In his role as institutional investor, he and his company focus on investments in technologies and spin-offs originating from Cambridge and take a very active part in the Network. This includes significant activities for the benefit of the Cambridge scientific and economical community, for example participation in the foundation of Cambridge Networks Ltd. This attitude is remarkably wide-spread among Cambridge based investors and service providers. It can be seen as being rather different from the 'hard selling' attitude which is widespread in the financial services industry and closer to an attitude of creating win-win situations by seeking an overlap between a Cambridge technology and a market need and enabling this to happen for the benefit of all involved parties.

Cambridge based technology consultancies have also mostly grown out of the local scientific environment and continue to maintain strong links with its scientific community. Today, many of them have evolved to more rounded technology houses and have become a major source of spin-outs and are now active in the seed and venture capital business also. Companies like Cambridge Consultants, PA Technology, Scientific Generics, etc. account for a headcount far above 1,000 employees, combined revenues far above 100 Mio. £ and for over 50 successful spin offs.

This large and somewhat heterogeneous community is linked by a multitude of networks and cooperation support platforms which support and facilitate interaction, collaboration and start-up activities (See Table 1 for examples). But it has been suggested that the reasons underpinning the success of Cambridge go beyond formal instruments applied and existing organisations and regulation. Recent studies emphasise the role of the general environment of the Cambridge region, including its pleasant environment and the absence of mass production industry. Urban development policy, characterised by a strong set of growth containment policies designed to preserve the special character of Cambridge and its surroundings seems to have also a positive influence[152]. The way in which the Cambridge actors do it seems to be what makes its success different. Three cultural success factors may summarise this[153]:

- *Community*

  In Cambridge there is a sense of being part of something significant and special that makes a real impact on the world. The Cambridge Network's strap line of 'Cambridge ideas change the world' perhaps best sums this up.

- *Collaboration*

  Because of the sense of community, organisations and individuals are typically very willing to help each other. This is reflected in the high level of engagement of the business community in educational activities throughout Cambridge.

[151] Amadeus Capital
[152] See Jonas et. al, 2003, for details
[153] Source: Cambridge Technopole Report 2006

Networking events and conferences	
Cambridge Corporate Gateway	▪ Provide international companies access to high technology cluster and university research
Cambridge Enterprise Conference	▪ Community platform for technology entrepreneurship practitioners
Cambridge International Manufacturing Symposium	▪ Forum for current industrial issues, best practice and application of state-of-the-art R&D in manufacturing
Horizon seminars	▪ Provide participants with a first look at new developments in leading areas of science and technology in Cambridge
Networks	
Cambridge Europe and Technology Club (CETC)	▪ Group of high tech businesses&service providers aiming to improve profitability, technical/ business skills and market penetration
Cambridge High-Tech Association of Small Enterprises (CHASE)	▪ Association of small high technology businesses, focuses on technology start-ups and small enterprises.
Cambridge Network (CN)	▪ Platform for working together & leveraging collective resources for the benefit of technology-enabled enterprise in the region. ▪ Over 1,100 members across business and government
Eastern Region Biotechnology Initiative (ERBI)	▪ Networking and communications organization to enhance regional growth and development of biotechnology in Cambridge and the East of England.
Enterprise Link	▪ Offers support for early-stage technology-based businesses, e.g. through networking, first-level advice, signposting & contacts. ▪ Launched in 1999 – now > 200 members.
Cambridge University Institute for Manufacturing (IFM)	▪ Supports manufacturers by helping to raise manufacturing skill base, develop innovative tools and techniques & industrial problem solving; best practice & new technique deployment services
Science parks and incubators	
Babraham Bioincubator	▪ Started in 1988; combined office and laboratory space for start-up and early stage ventures.
Cambridge Science Park	▪ Started in 1970; premises for over 60 science-based firms
Granta Park	▪ Research & development park, covering 86 acres, 7 miles south east of Cambridge.
Melbourn Science Park	▪ Premises for technology-based firms. Park now owned by TTP
St Johns Innovation Centre	▪ Started in 1987 – Provides business support and accommodation for 50 early stage knowledge based companies
Cambridge Research Park	▪ 112 acre R&D and office park
Councils and support for new and growing businesses	
Greater Cambridge Partnership (GCP)	▪ Umbrella organisation of Public and Private Sector interests for the region
Business link for Cambridgeshire	▪ Impartial advice and business support for Cambridgeshire businesses
Gateway2Innovate	▪ Promote & support innovation through links with business service providers
Private investor and business angel networks	
Cambridge Angels	▪ Business angel group to accelerate early-stage investments in Cambridge start-ups
'Choir of Angels'	▪ Informal group, "investing in businesses we can understand, so we can contribute more than money"
Great Eastern Investment Forum (GEIF)	▪ Privately initiated business angel network ▪ >320 members consisting of individual investors, VCs, corporate investors and professional advisors

Illustrative examples

Table 1: Illustrative examples of technology business related networks, science parks and incubators operating within Cambridge[154]

[154] Source: Cambridge Technopole Report 2006, own research

- *Constructive Chaos*
  There is no group that 'organises' Cambridge. New initiatives are springing up continuously – some succeed and some fail. This may be perceived as inefficient from one standpoint, but does result in a highly entrepreneurial environment.

2.2 Cambridge University's approach to Private Sector interaction

The University of Cambridge is a confederation of Colleges, Faculties and other institutions. These have a high degree of independence and define their own research priorities, including their approaches to research partnerships with the Private Sector. The University functions with a relatively small central administration. Traditionally, it has limited its activities in the areas of research collaborations with the Private Sector and commercialisation of research results consciously to the provision of services for business liaisons, commercialisation of research results, etc. But the university has refrained from imposing a specific approach on the collaboration activities of its academic staff, with the exception of agreed guidelines, e.g. on the allocation of income from such activities ("… We have a policy of having no policy…"). Academic staff enjoys a relatively high degree of freedom to have links to industry and retain intellectual property rights to work.

This approach has changed during the past decades. We can roughly differentiate between three phases[155]:

1. Until approximately 1998 a rather diffuse and liberal approach predominated. A small unit formed within the Engineering Department to facilitate technology transfer in 1960 became later the Wolfson Industrial Liaison Office (WILO). Intellectual property rights were not automatically assigned to the University if they were supported by a Research Council grant until a revenue share agreement was put in place that divided any results of commercialisation activities between the inventor, their department, and the University in 1987[156]. This policy granted significant independence to scientists in negotiating with industrial sponsors and engaging in research commercialisation.
2. From 1998 until 2002, a new structure for technology transfer activities and a new IPR policy emerged. IPR generated by externally funded research was now owned by the University (except where the University has agreed otherwise). Revenues generated by the exploitation of such IP were shared between the inventor, the Department and the University. A new integrated framework for technology transfer took a more proactive approach and involved the University more directly in the commercialisation of research and in the promotion of entrepreneurship. A number of organisational units were introduced to deal with technology transfer and with the University's external research funding from industry and other sources (Research Services Division RSD with a dedicated Technology Transfer Office), to provide funding for University of Cambridge spin-outs (University Challenge Fund) and to provide training and support for entrepreneurs (Cambridge Entrepreneurship Centre).
3. After 2002, the integration of services into a single organisation *Cambridge Enterprise* began. The aim was to improve the support available to the academic community to make their ideas and concepts more commercially successful for the benefit of themselves, the University, and the UK economy. Entrepreneurship related teaching and training activities are now delivered under the umbrella of the Centre for Entrepreneurial Learning, with a strong link to the local business community. The University Challenge Fund was maintained to make investments in University spin-outs from its own reserves.

[155] Based on Minshall 2005
[156] In cases where the research had been funded through some other route, either the funding sources brought their own obligations or academics could claim ownership of their inventions.

Commercial incubation and science park facilities are provided by Cambridge colleges such St John's and Trinity[157].

These organisations perform often a variety of different functions in support of collaboration and start-up activities (see Table 2 for an example).

These university initiatives are complemented by student initiatives, e.g. Cambridge University Entrepreneurs, a student-run organisation which manages three business plan competitions for members of the University.

Functions hosted by ST. John's Innovation Centre	
Physical incubator	'Home' for up to 50 high-technology related businesses.
Virtual incubator	Hands-on support for 500+ non-tenant nascent ventures.
Rent-an-address	Provides mail and telephone services to 180+ non-tenant ventures.
High Growth Start-up Services	Supports local companies with business plan development and training in conjunction with University of Cambridge Enterprise, funded by Cambridgeshire Business Services.
Enterprise Link	Networking, events and advice for +600 early stage technology ventures.
Innovation Relay Centre (IRC)	Gateway to extensive technology & business network spanning 30 countries across Europe
Gateway2Innovate	Working with business service providers throughout the East of England to promote and support innovation in the region.

Table 2: Important functions of St. John's Innovation Centre related to research collaboration and spin-off activities[158]

Cambridge Enterprise and related organisations within the University have numerous links with the local business community. This includes conferences and events (such as the Cambridge Enterprise Conference and 'Horizon' events, showcasing University technology to the business community, networks, investor groups and locally active Business Angel networks (such as Cambridge Angels and the Great Eastern Investment Forum), a Business Mentor Programme (initiated by the Entrepreneurship Centre and KPMG to leverage the experience of around 100 local managers and entrepreneurs), science parks and incubators and the membership in the Cambridge Technopole Group, bringing together business support organisations from the private, public and academic sectors.

2.3 Research collaborations between Public and Private Sector

As explained in chapter 1, the high degree of autonomy granted to researchers at Cambridge University has led to a rich spectrum of approaches to Private Sector research collaboration, often with high degree of commitment from both sides. For inward investors, access to local knowledge in academic research is an important part of their technology strategy. To realise this, externally based large firms become deeply embedded in the local milieu, thus creating more and more profound links with the research community as well as stronger inter-firm links. The intensity of these links exceeds the level which they could obtain in a 'fly in – fly out' type collaboration. At the same time, collaboration with leading industrial innovators and an established 'Industrial Supporters Club" for institute, faculty of researchers are also attractive reasons for academic research to seek such co-operations.

Following these patterns, long established large firms such as Phillips, Ciba Geigi or TWI and newer arrivals like Microsoft (European Research Centre), Nokia or Johnson Matthey established research local implantations and began to become parts of the network. In the course of this development, traditional concepts of contract research, technology transfer, etc. were extended. In order to secure competitive advantage through cooperation further down the

[157] The only business accommodation provided by the University is a small business incubator that utilises space within the Computer Laboratory.
[158] Source: *Cambridge Technopole Report*, 2006

value chain without having to compete for access to knowledge at an early stage, a growing number of companies engaged in embedded laboratories. Such co-locations of scientists from the firm with academics gained importance. Prominent examples include the Glaxo Institute for Applied Pharmacology, SmithKline Beecham in the Department of Medicines Clinical School, Hitachi in Physics or the BP-Institute in Fluid dynamics[159].

However, experience with such embedded laboratories has shown that they do not operate without frictions. Large global companies are on one hand attractive partners for research, because they are more concerned with emerging technologies than with short term development goals and offer considerable own scientific knowledge and resources in a partnership. But on the other hand, such an intense collaboration in a shared research space creates intersections between the faculty's or department's research strategy and corporate objectives. Through this, Private Sector enterprises may gain wide influence in collaborations with the university, thus creating a perception of researchers that their freedom to research may suffer. At the same time, Private Sector companies sometimes feel that their delegated staff members hosted at the university becomes 'captured'. The allocation of IP generated in such constellations can become another controversial issue.

Therefore in recent years the trend towards embedded laboratories has slowed down. The pendulum seems to swing now towards 'approximate laboratories' which are still located on or close to the university campus, but offer clearer and more transparent boundaries between joint research and the partners' own core research sphere.

An example for an alternative approach is Intel's launch of its Cambridge 'Lablet' in the Gates Building. This work was carried out under a public domain arrangement ('Open Research Policy'), no other specific framework agreement was in place (other than lease for space). This avoided IPR issues as well as some of the resistance which had been coming up for example during the early stages of the Microsoft engagement, where fears were raised that Microsoft could 'buy' (i.e. dominate) the Computer lab.

Small to medium sized technology-based businesses can also benefit substantially from this kind of collaborative partnership. An example for this, showing again the importance of personal contacts, is Thomas Swan Co.'s[160] research collaboration with the Department of Materials Science and Metallurgy. First contacts were established when the company donated some equipment to the department. As a result, a company representative met two professors by chance and the idea of a research collaboration on carbon nanotubes was discussed. As a result, a research project on scaleable, unique production methods for carbon nanotubes was launched. Seven patents have been filed since 2001 and these have been licensed through the university's technology transfer office to Thomas Swan Co. Further developments from Cambridge are already influencing the design of the Phase II and III plants. The department has benefited from the training of three post-doctorate researchers, one of whom has subsequently gone on to work for Thomas Swan Co. The project also indirectly supports other projects in the department because Thomas Swan Co. has allowed access to its nanotube technology. Both the university and the company emphasise that the success of their partnership depends on the long-term and two-way nature of their relationship and the trust that develops over time. Each partner contributes to the research collaboration and shows understanding and flexibility towards the priorities and objectives of the other.

[159] Illustrative examples, not comprehensive, some of them discontinued.

[160] Thomas Swan Co. is a small privately owned company based in the North East that develops and sells specialty chemicals, actively seeking out new materials, processes and technologies based on the latest scientific breakthroughs in universities (Source of example: Lambert review)

3. Impact of Private Sector involvement and effectiveness in leveraging publicly funded RTD/stimulating Private Sector RTD investment

The impressive growth of the Cambridge research and technology would not have been possible without the described intensive interaction between Public Sector research and the Private Sector. The participation of the Private Sector went far beyond traditional investment in short term opportunities, contract research, etc. The university's capability to attract this commitment through its combination of scientific excellence and stimulation of researcher's commitment in a liberal environment has been a key success factor to reach this win-win situation.

Private Sector investment in university research and in spin-outs from Cambridge continues to be an important growing component of regional economic development. Equally important in this respect is the university's role as a source of technology and technological know how. The resulting contributions to enterprise competitiveness and innovation create and leverage Private Sector investment in research and innovative technologies, thus contributing also to the creation of high quality employment in growth sectors of the economy.

At the same time, this has also important implications for the university. With a volume of over 176 Mio. £, income from research has been the biggest single contributor to the University's income 2003-2004 of 495 Mio £[161]. This is an important contribution to achieve the goal of long term financial stability and independence.

To maintain and build its teaching and research strength and to attract and retain leading scientists and high potential students, the university must continue to develop a growing stream of income from the commercialisation of its research. However this has to be done in a way which does not jeopardise the unique environment and cultural elements which make research cooperation in Cambridge specifically attractive for both sides. The modernisation of governance and management structures and the further development of a stringent framework for the commercialisation of research results represent particular challenges. This has to balance carefully the need for coherence between colleges/researchers and the university as a whole and the protection of their academic and social strengths as a basis for maintaining the entrepreneurial spirit.

4. Conclusions and transferability

Until the late 1990s, the establishment and success of research partnerships between Cambridge University and the Private Sector and of start-up activities had been based upon an enthusiastic, ad hoc approach with a minimum of formal rules. The university's scientific excellence and reputation and its liberal atmosphere have been instrumental to attract many technology oriented Private Sector companies which invested in research partnerships and local operations and stimulated the creation of a complementary local private equity scene which plays a key role in financing new ventures.

But new external influences create a pressure to change. Growing global competition, demands for measurable research benefits for society and the University's desire to maintain its financial independence ask for a more systematic, supportive and appropriately resourced approach to the commercial exploitation of Cambridge University's wealth of knowledge and creativity. With the formation of Cambridge Enterprise and the revisions to its IPR rules, the University the University has taken steps into this direction.

Cambridge University is also working on new approaches to strengthen its links and interaction with the Private Sector. Such an initiative was the launch if the Cambridge-MIT Institute (CMI) in the summer of 2000 as a joint venture between the two universities. Financed largely by UK Government grants, the objective was to make a step change in the approach

[161] Source: Probert, D., *Technology Transfer at the University of Cambridge*, Presentation at the Technology Transfer Seminar, JST Hall, Ichigaya, 23. March 2005

to knowledge exchange between universities and business, based on MIT's extraordinary reputation as a hub of entrepreneurial activity. After a first phase, critics said that the project got off to a poor start, because its objectives were not set with sufficient rigour, and its internal controls were weak. Therefore a new strategic plan refocused the programme on a innovative ideas aimed at improving the effectiveness of knowledge exchange, educating future leaders and developing programmes for change in universities, industry and government. A key element are so called knowledge integration communities, which bring together graduates, academics, other universities, companies, suppliers and government agencies to foster in-depth and interpersonal business university engagement from the very start on specific knowledge transfer projects[162].

But this development requires a careful balance between the advantages of a more dedicated and controlled approach to exploit the University's knowledge pool and the entrepreneurial spirit and personal initiative which the traditional liberal approach has stimulated in such an impressive way. For example, in the intensive debate about new IPR regimes, it was argued that on one hand the previous 'loose' IPR regime has been instrumental in the emergence of an active technology commercialisation environment, but on the other hand the University has missed many opportunities by not maintaining tighter controls over IPR and managing its exploitation more actively.

This is even more important when considering the described larger Cambridge scientific and economic community with its multitude of actors and networks and its unique collaborative spirit. Especially this model may not be transferable to other university-centred clusters one-to-one. It has grown organically over decades from an 800 year old university tradition and is based today on an existing critical mass of researchers, students, businesses, etc., on established networks and on traditions and experience in the foundation of high-tech start-ups. This unique environment can not be rebuilt easily in a Greenfield approach or by adaptation of existing structures.

However, some of its key factors may serve as guidance for the development of other clusters where a comparable base exists and where an intensive interaction of Private and Public Sector is sought to create leverage from a strong academic research core. These include

(1a) a world class academic research base as nucleus, in conjunction with

(1b) a liberal atmosphere which encourages researchers' own initiative and provides recognition for successful founders beyond monetary incentives;

(2a) a critical mass and a diverse 'landscape' of other actors, providing demand, inspiration and support, including technology firms, venture capital, etc., in conjunction with

(2b) numerous links between academia and the business community in an 'intimate' and trustful atmosphere;

(3a) an overall environment which is attractive for the best researchers and other key individuals as a work and personal location, supported by

(3b) consistency between local, regional and national research and technology policies and related policy areas, including legal framework, regional development, etc.

(4) creation of an auto dynamic development process, which is driven by the actors and supported by highly visible success stories and other measures (in the sense of 'marketing' cluster and location) to fuel further growth through the acquisition of leading students, academics, research partners and technology industry investors.

[162] See the *Lambert Report* for details.

Appendix A: Additional important literature and information[163]

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A5.6 Case study: Cluster-oriented policy to strengthen and upgrade regional capabilities – the Pázmány Péter – Regional University Knowledge Centre programme in Hungary

1. Policy and institutional context

Mismatches between the different components of its innovation system accounted for one of Hungary's biggest 'systemic failures'. As was the case in other former socialist countries, the initial level of co-operation between Government and enterprises after the beginning of the transformation was very low and not comparable in its nature with western countries. Many failings of the old system were therefore coded into the new institutional structure and the economic environment. To overcome this systemic failure, Hungary is re-coding its institutions and in particular the relationship between academic research and Private Sector innovation in an attempt to create the proper policy and economic environment for a modern, knowledge-based economy.

The emerging vision of the modern, innovative Hungarian economy, which can compete successfully in the global arena, made it absolutely necessary to encourage business firms to be innovation-oriented and to encourage universities to develop, beyond their traditional teaching mission, also their research performance and their capabilities to transfer research results and new knowledge to convert them into commercially relevant innovations. The role of government was to create a suitable legal environment and proper incentives to stimulate and support change and to enable collaborations between Public and Private Sector actors.

In the first period of this transition (1990-1996/8), the majority of new laws relating to the national Science and Technology (S&T) system were enacted (laws covering the Academy of Sciences, Higher Education, Intellectual Property Rights and Public Procurement). The law on higher education (enacted in 1993) defined the tasks of a dual transformation of universities: The return of research to the broken-winged universities and their transformation from traditional, teaching-oriented universities to research-driven, modern academic institutions[164]. The legal framework for co-operation between government and universities was laid down and R&D governance commissions were established. The 1996 amendment of the Higher Education Act introduced a normative higher education research support system where a part of the budget is earmarked for the direct support of R&D. This law and other newly introduced measures were instrumental to encourage the reform of higher education organisations' research strategies and to enhance their research-based interactions with other stakeholders of the Hungarian Research and Innovation System. But practical experience showed that a lot of subsequent fine-tuning would be necessary.

The second wave of legislation in the years 2003-2005 refined the system, adjusted it to the new international environment (e.g. Bologna process, Barcelona targets) and harmonised it with EU legislation in preparation of Hungary's membership. It encompassed the following:

- *Act CXXXIV of 2004 on Research and Development and Technological Innovation* allows public organizations, e.g. universities, to participate in the creation of enterprises on the basis of scientific research results and technological innovation. The law encourages also Public-Private-Partnerships in knowledge exploitation and allocates a high priority to collaborative research and innovation activities, primarily between public research organisations and Private Sector enterprises.

[164] Important milestones of Hungarian transformation include: Introduction of masters and PhD curricula, new evaluation and grant system for professors in view of research quality, grants for PhD students, accreditation of universities, higher education research bidding system and participation in EU-funded co-operative research programmes. In this process, mergers of higher education institutions were enforced by authorities. But at the same time, they developed to autonomous organisations. And an organisational framework evolved, including Rectors' Conference, trade unions for scientific personnel, etc.

- *Act No. XC of 2003 on the Research and Technological Innovation Fund* enables support for application-oriented research and innovation.
- *Act XXXVIII of 2005 on Higher Education* regulates how universities can establish or participate in the establishment of knowledge utilisation organisations and spin offs.

These new laws framed an improved environment for knowledge transfer and collaboration between universities and Private Sector enterprises. This was one of the government's declared main research policy priorities since the beginning of the transition to a market economy, together with the stimulation of business demand for R&D, enhanced technology transfer, the promotion of innovative, technology-devoted SMEs, the preservation and strengthening of national R&D capabilities and access to international networks.

Only in 1995, a first programme[165] started to provide specific support for this purpose. The time-line of government calls shows that until 2000 the stimulation of research collaboration was a secondary research policy priority.[166] But the new programmes allocated a higher priority to the development of collaborative research projects. Private Sector associations and representatives contributed to instigation and design of this policy measure (e.g. through membership of a politically recognised business representative in the OMFB Council).

The first programme which made collaborative research an important priority was the *Cooperative Research Centre* programme (CRC, launched in 2000). This programme made universities the 'centres of gravity' of research collaborations to develop and leverage their potential as drivers of growth in a knowledge-based economy[167]. The programme induced the establishment of CRCs and supports their operation in close relation with Hungarian higher education institutions, other non-profit research facilities and Private Sector enterprises. In the CRCs, education, research and development, knowledge and technology transfer are integrated for strategic purposes. In a CRC "…the leading institutions of the consortia may only be those offering PhD courses and accredited by the Hungarian Academic Committee[168]". And it can only be established in a partnership with Private Sector partners.

A new large-scale programme, the *National Research and Development Programme of the Széchenyi Plan* (NRDPS) was launched in late 2000 to promote collaborative research in consortia with Private Sector participation, led by Higher Education or academic research institutes. The formation of consortia is mandatory except in the Social Science Programme.[169]

Despite all these efforts, the competency and attractiveness of universities for strategic research partnerships with the Private Sector remained heterogeneous and partially unsatisfactory because of shortcomings in their knowledge base and their capability to act as well-performing research partners in collaborative projects. Table 1 summarises these limitations of Public Sector research collaborations with Private Sector enterprises.

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165 The programme was called *Promotion of Applied Research*.

166 For more details see Inzelt 2004.

167 However, decision-making was also influenced by the restructuring of the administrative and government elements of the national research and innovation governance system.

168 Quotation from the call for tenders.

169 The NRDPs are built on a tender system focusing on five fields: (1) improving the quality of life, (2) information and communication technologies, (3) research into environmental and materials science, (4) research into agribusiness and biotechnology, and (5) research into the national heritage and contemporary social challenges. Members of consortia may be any legal entities and organisations without legal status registered in Hungary. Any research institution or business venture registered in the EU or in associated countries can join the consortia. But they are not entitled to Hungarian government funding (www.om.hu).

Shortcomings of Public Sector research collaborations with the Private Sector
▪ Few companies regarded universities as crucial innovation partners. As a result, the interaction in collaborative research had an *asymmetric* nature, with a very limited number of universities and enterprises involved and a focus on few disciplines, predominantly in the areas of natural, engineering medical sciences.
▪ Short-term market-oriented research contracts had evolved as the predominant form of Public Sector - Private Sector research interaction. These helped to solve short-term development problems of enterprises, but did not provide a basis for a *stable long-term relationship* which provides continuous knowledge transfer for the Private Sector partner and reliable sources of income for the Public Sector research institution. Such strategic partnerships were rare.
▪ According to the judgement of several important Private Sector R&D representatives involved in collaborative research, only few universities had the capability to mobilise the necessary *critical mass* of research capacities and competencies. This was partially due to their absence, but partially also due to limited university in-house collaboration.
▪ *University-internal regulation and processes* did not support collaborative research to the necessary extent. For example, the allocation of Intellectual Property rights remained unclear and the reform of the administrative/economic functions and governance structures of universities had to be pushed further towards efficient structures.

Table 1: Shortcomings of Hungarian industry-university collaborations

In view of this gap, several Private Sector representatives made a strong case vis-à-vis policy makers to further improve legal and other framework conditions and to implement the new policy guidelines consequently. Another recommendation was to create incentives which stimulate a changed attitude of Public Sector researchers and enhance their commitment to Private Sector research collaboration. These interventions contributed to the launch of the above-mentioned second wave of legislation. And they were also instrumental for a newly initiated complementary programme which addressed particularly these shortcomings, the *Pázmány Péter – Regional University Knowledge Centre programme*.

2. Detailed description

2.1 Programme overview

Based on the assumption that universities could be a magnet for regional development, the new *Pázmány Péter – Regional University Knowledge Centre* programme was developed. In this role, they attract leading-edge, technology intensive enterprises in search of research, development and education partners. In addition, the formation of spin-off companies and of innovation clusters with a critical mass of competencies and actors is stimulated in support of regional business areas in different parts of the country. Both federal and regional authorities, as well as various Private Sector stakeholders, contributed to the initiation of the programme. Debates about how to shape the programme were held in different formal and informal forms.

The design of this programme was also influenced by its predecessor, launched by the Ministry of Economic Affairs and Transport in the frame of the 'Programme for Technological Development and Innovation'. This programme aimed to support knowledge-based collaborations, to upgrade transfer of knowledge between university and industry, to make universities more attractive partners for R&D laboratories of Multi National Companies (MNCs), and to link (potentially) innovative SMEs to knowledge centres in regional clusters.[170] To achieve intensified collaboration, Public-Private-Partnerships were sought in this context. Govern-

[170] Source: GKM Document, 2003.

ment funding should mobilise complementary Private Sector resources and enforce a strong Private Sector impact on resulting research. This programme started with a call for feasibility studies, including the preparation of draft operational plans in 2003. Already this preparatory process led to enhanced joint thinking on strategic issues and had a positive impact, not only on the on-going legislation procedure but also on collaborative R&D[171]. In early 2004, the Ministry was not able to facilitate the designed strategies of the winners, but launched another call to support the infrastructure development at already established innovation and scientific centres. Three centres received grants under this scheme.

When the funding situation changed, there was a rearrangement in governmental structure. The Research and Technological Innovation Fund established at the end of 2003 offered much more generous financial support than support previously allocated by the GKM.

A new governmental agency and its Council were established. The Council of Research and Technological Innovation formulated its own strategic objectives, including the intensification of university-industry collaboration, the strengthening of regional knowledge-based capabilities and the development of clusters in high value-added sectors. An operative government agency, the National Office for Research and Technology (NKTH) was responsible for the development of the new *Regional University Knowledge Centres* programme[172], based on these principles. The first call for tenders was launched in the autumn of 2004.

2.2 The Regional University Knowledge Centres Programme

The programme objective is to stimulate the development of regional knowledge centres as joint Public and Private Sector consortia, centred at university sites. These knowledge centres aim to integrate the regionally existing knowledge-base and to support its development by the members for mutual benefit. For this purpose, they foster research collaborations, spin-offs, start-ups, and other innovation activities with a high relevance for regional development. The policy programme promotes the creation of such centres and supports their first years of operation financially with the objective to ensure a sustainable cluster development.

Under this framework, the independent partners of the consortium formulate jointly targets and strategies for collaborative research and the exploitation of its results. To enable such research on a state-of-the-art base, a critical mass of participants is crucial to ensure the necessary financial resources, trained staff and implementation power.

For this purpose, two calls were launched until now. The first call was issued October 4, 2004, the second one April 29, 2005. The winning consortia obtained access to funding by the programme, financed by the Research and Technological Innovation Fund (established at the end of 2003). Following the Public-Private-Partnership model, where the state is not the single supporter of the programme, the participating Private Sector actors provide complementary funding. In addition, the centres can also attract external funding, e.g. from regional authorities, local and international financial investors and venture capital, non-profit investors, foundations or EU research programmes. In addition, Private Sector enterprises make advanced technical equipment available for use by members and non-members.

Two important experiences from the first round of centres funded led to modifications of the criteria used for the second call: (1) The short time available for the preparation of applications was criticised by several applicants. Therefore it was extended for the second call. However deadlines were kept short because the timeline of the second call since was known and because preference was given to support for regions, where at least a basic level of collaboration and dedication to partnership-building existed already. (2) The initial requirement to submit a 10-year strategic plan was released in the second call. This modification was based on formal logic: If the grant is available only for three or four years, any plans beyond

[171] The winners of this call concentrated in Budapest, but there was one representative from both Northern Hungary and from the Northern Great Plain region. All of Trans-Danubia was absent.

[172] renamed subsequently Pázmány Péter.

this time frame should not be part of the selection criteria. However, this remained a controversial issue because policy makers' intention is to instigate sustained long-term research collaboration by supporting their initial development phase where they are particularly vulnerable. On the other side, it was argued that the majority of applicants have a credible long-term vision and dedication, which is a sufficient base for long-term joint activities, while formulation of a formal 10-year strategic plan might remain a theoretical exercise under the current, highly fluent external conditions.

Table 1 summarizes the characteristics of the two calls. Compared with the first call, the second call targeted less centres with a lower overall budget. The minimum grant size and the duration of support were also reduced.

Issues	2004	2005
Maximum number of granted applications	5	4
Duration of support (months)	48	36
Allocated budget (Million HUF)	9,000	6,000
Minimum sum per project (Million HUF)	1,440	1,000
Period between launching calls and deadline for application (in calendar days)	31	48

Table 2: The key characteristics of the calls

To evaluate the applications, monitor and evaluate the projects (with the help of expert reviewers), a programme governing committee was nominated by NKTH for the duration of each call. Two business representatives in each committee ensured an appropriate Private Sector involvement[173].

2.3 Implementation of Regional University Knowledge Centres

The 12 existing centres encompass 91 founding members from the Private Sector, including 43 SMEs. The programme provides flexibility for the winning regional consortia to develop and pursue tailor-made approaches for their specific research issues and regional environment. As a result, centres have developed different structures with Private Sector partners ranging from a group of SMEs cooperating with a single large multinational company to a grouping of several large companies. Figure 1 shows the stylised centre structure.

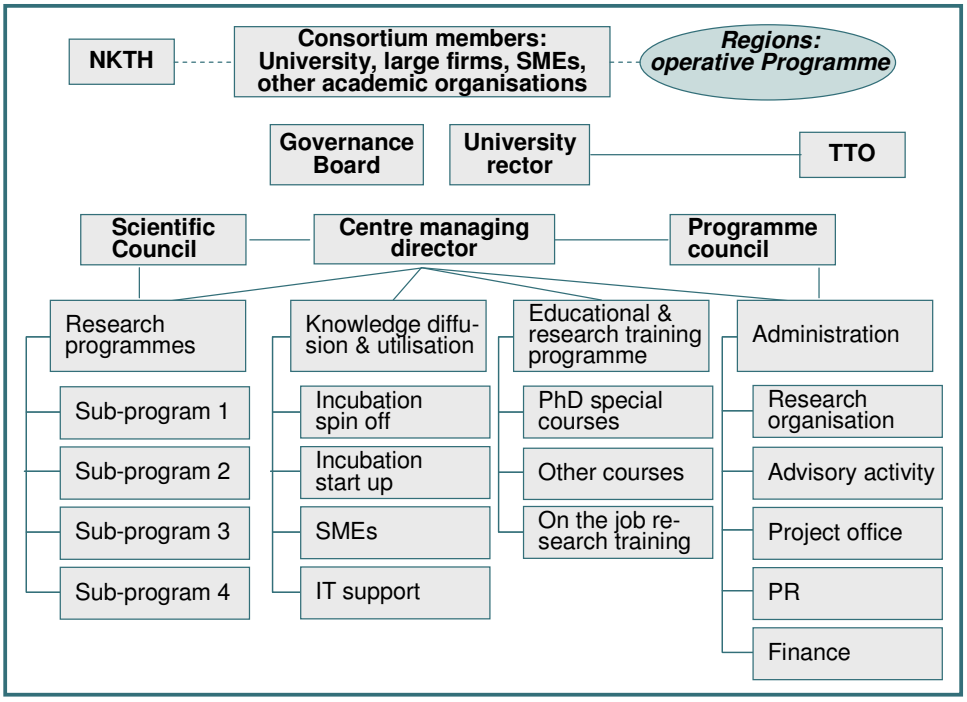

Figure 1: Stylised Structure of Regional Knowledge Centres

[173] Source: RTI Fund

The centres' research activities are characterised by a high degree of inter- and trans-disciplinarity, where various university departments work together in targeted research programmes. The Private Sector participants have a leading role in setting the research agenda and participate in the Centre's research activities as an active partner in projects, as a 'client' or as user of facilities. The number of research programs varies by centres.

The evaluation of the first round's winners started in November 2005. The programme governing committee evaluates the performance on the basis of several criteria, which are partially newly introduced in Hungarian evaluation schemes. Table 3 summarises the common criteria applied in regular monitoring and performance evaluation of all centres.

Regional University Knowledge Centres (Hungary) Performance Evaluation Criteria	
1	***Scientific performance*** Scientometric methods; scientific awards; dissertations; integrated and acknowledged in the international scientific network.
2	***Human resources*** ▪ Utilisation of research results in education ▪ Nr of graduate students, PhD Students, young researchers involved in the projects ▪ Nr of fresh scientific degrees ▪ Nr of new jobs (mainly technical personnel and post-doctoral positions) generated at private firms, at research organizations
3	***Knowledge transfer and the industrial utilisation*** ▪ Number of patent applications and registered patents (national, PCT, foreign) ▪ Number of other IPRs ▪ Patents reaching the phase of licence selling, and the amount of income thereof (which the researchers will directly financially be part of). ▪ Number of developed new products, process, service, prototype and innovation

4	***Economic utilizations***
	▪ Nr. of participating research organizations and private firms
	▪ Nr. and sales of start-up companies,
	▪ Nr. of generated spin-off by projects
	▪ Mode of utilization (product sales, selling licence and know-how)
	▪ Project results
	  ▫ Additional total incomes (in which export income)
	  ▫ Diminished costs

5	***Societal utilization***
	▪ Project contributed to
	  ▫ Sustainable development
	  ▫ Equality of chances
	  ▫ Security
	  ▫ Moderation of regional inequality
	▪ Public presentation of projects to
	  ▫ Professional audience
	  ▫ General public

6	***Other criteria*** Evaluating personal and management competencies (team-work, managerial competencies, strategic orientation, organisational innovation, adaptability to changes, presentation skills), project marketing

Table 3:Evaluation criteria of the Regional University Knowledge Centres

3. Impact of private sector involvement and effectiveness in leveraging publicly funded RTD/stimulating private sector RTD investment

The *Pázmány Péter – Regional University Knowledge Centre* programme was initiated in order to help correct historically grown inefficiencies in the Hungarian research system and to accelerate in particular the development of Public Sector – Private Sector research collaboration. At the time of preparation of this study, the following effects can be observed:

a. "Kick start" for the mobilisation of (potential) clusters

For the first call, 12 applications were received and 6 grants were awarded. For the second call, 15 applications were received and again 6 grants were awarded. The total grant amount was HUF 15 billion for two calls. As a result of the increased support for collaborative R&D in the centres, Private Sector participation grew considerably from a share of 12% of the grant volume in 2004 to 30% in 2005. Private Sector contributions were HUF 2.31 billion in 2004 and HUF 2.58 billion in 2005. The Private Sector contribution constituted 26% of available financial resources in 2004, and 43% in 2005, meaning that additional financial resources were significantly larger in the case of the 2nd call. The number of Private Sector members in the applications was 72 in 2004 and 96 in 2005.

The ratio between applications and awarded grants was 1:2 for the first call and 1:2.5 for the second call. Grant sizes are not comparable, because the duration of support was shorter in the second call than in the first, which affected the total sum of grants and the size of grants to individual centres.

Issues	**2004**	**2005**
Nr of supported applications	6	6
Nr of applications	12	15
Nr of regions by origin of all applications	7	6
Nr of regions by origin of granted applications	5	4
The total sum of grant (M HUF)	9,000	6,000
The smallest grant (Million HUF)	1100	500
The highest grant (Mio. HUF)	1700	1200
Average amount of the support of an application (Mio. HUF)	1,500	1,000

Table 4: The results of the two calls

In the implementation of both calls, some tender conditions were modified, because the governing committee wanted to ensure a sufficiently large sample of centres. Therefore, six applications were accepted in each call despite a limited overall programme budget (instead of five and four for the two years, as was announced in the calls), but with lower average grant sums.

In the calls, the minimum project budget was 1440 and 1000 respectively, but the smallest awarded grants were 1100 and 500 respectively.

Overall, the scheme has proven its capability to strength region specific clusters. The winners include 10 out of 25 Hungarian universities. Each region - except Central Trans-Danubia - has at least one knowledge centre.

From 12 centres that were set up in 2004 and 2005, five were established in Central Hungary, mostly in Budapest and its surroundings, where

Regions	Total	Natural resources	Biological & pharma	Nanotech-nology	ICT	Vehicles
Great Plain						
▪ Northern	1			1		
▪ Southern	2		1	1		
Central Hungary	5	1	1		2	1
Northern Hungary	1					1
Trans-Danubia						
▪ Western	2	1				1
▪ Southern	1		1			
▪ Central						
Total	**12**	**2**	**3**	**2**	**2**	**3**

Table 5: Number of RETs by fields and regions in 2005

large, established universities are located. In Budapest, around the country's largest technical university, BME, there are two knowledge centres: (1) *IT2*, focused on information technology and (2) *Advanced Vehicles and Vehicle Control*. The largest medical university, Semmelweis University, Budapest hosts one knowledge centre, *Szentágothai János* which focuses on *molecular biology and info-bionics*. With its strong natural sciences faculty, ELTE University, Budapest is the centrepiece of the *e-Science Regional University Knowledge Centre*. The fifth centre of the region is located outside of Budapest, mainly in Gödöllő, at the Szent István University, a Centre of Excellence in *Environmental Industry* based on Natural Resources.

The University of Szeged in the Southern Great Plain region has attracted two centres: (1) *Environmental and Nanotechnology* that includes the development of integrated systems for the improvement of the quality of life; and (2) the *Neurobiological Knowledge Centre*.

Western Trans-Danubia has also two knowledge centres, attached to two different specialised universities with a strong link to their regional economic environment. The centre of *Forest and Wood Utilisation* is linked to the West Hungarian University in Sopron and the Széchenyi István University-based Knowledge Centre for *Vehicle Industry* is located in Győr.

Three other Centres are linked to other regions' largest universities: the *Genom-Nanotech Debrecen Knowledge Centre* at Debrecen University in the Northern Great Plain region, the *Centre of Knowledge-intensive mechatronics and logistics systems* at Miskolc University in Northern Hungary and the *Southern-Trans-Danubian University Innovation Knowledge Centre for Developing Medicines and Methods of Treatment to Improve Life Quality* at the University Pécs ; in Southern Trans-Danubia.

As an example of such a successful regional initiative, the appendix of this case study provides a detailed description of the *Szentágothai Knowledge Centre (SzKC).*

b. Private sector involvement and effectiveness in leveraging publicly funded RTD/stimulating private sector RTD investment

Because of the short history of the programme, it is too early for a final evaluation of the programme's impact on Private Sector involvement and resulting leverage[174]. But obviously, it has attracted a considerable number of business partners. The 12 consortia have 91 Private Sector members and many other partners. Among the Private Sector members, 48 are large firms and 43 are SMEs. The majority of centres involve a larger, mixed group of Private Sector partners[175]. Besides these formal members, centres have also developed partnerships with other small businesses in their regions. And some of them are also preparing spin-offs.

Changes of the programme regulations encouraged Private Sector participation further. For example, the first call employed a complicated method to calculate the level of support: Private Sector participants could obtain 100% support for basic research, a maximum of 60% for applied research costs and a maximum 35% of the cost of experimental development[176]. Fulfilment of additional criteria allowed to increase this support to 75 or 50 % respectively under certain conditions) This very complicated calculation method was revised after interventions from both Private Sector participants and the programme governing committee (In particular by its Private Sector members) A simplified calculation in the second call defined that Private Sector organisations could obtain 50% state support for their programme-related R&D expenditures. As a result, business members of the consortia established in 2004 received 12 % of the total support in the year of winning the grant, compared with 30% in 2005.

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[174] The first monitoring exercise started recently, but will only be concluded after the end of this study

[175] With some exceptions: One centre has only one single large business partner and several small ones. Another one consists of several large MNCs with no SME participation.

[176] Public Sector research organisations can receive up to 100% financing for their activities.

In the context of the 2004 call, Private Sector members of consortia added twice the amount of state grants. For the 2005 call, this relation was 1.5. According to our interviews, business members are willing to invest more and to launch additional joint projects.

In a preliminary summary view, after a time-consuming ramp-up period and the implementation of some improvements, the programme has achieved its objective to stimulate the formation of regional research and innovation clusters and Private Sector research investment therein.

4. Conclusions and transferability

The enhancement of interaction between the different actors of their innovation systems is vitally important for economies in transition. Backed by strong political support and new legislation, Hungary's dedicated research policy approach has certainly made progress in this area through the described trials and errors-based approach of governmental agencies in setting up programmes for this purpose.

As a key element of this initiative, the Pázmány Péter – Regional University Knowledge Centre programme provides a potentially transferable example for other countries with shortcomings similar to those of Hungary's National Science and Innovation System. It was the first policy measure which has attracted a large number of actors and united them in joint regional research activities. The centres have created and/or brought forward forms of Public Sector - Private Sector research collaborations which are crucial for the flow of knowledge, the seamless transfer of research results to commercially relevant innovation and for feedback loops in development. The centres offer a stimulating environment for innovators and potential innovators, thus contributing to make the Hungarian economy more competitive.

In the assessment of the transferability of this research policy approach, the lessons of the initial programme period have to be taken into account:

- *Private Sector involvement*

  Through its capability to stimulate Private Sector research activities and to strengthen its links with Public Sector research, the Pázmány Péter – Regional University Knowledge Centre programme contributes to Hungary's efforts to reach the Barcelona target of 3% of national R&D investment, from which two thirds are Private Sector financed. In this particular scheme, the Private Sector contributed 20% of the total budget of first year winners and 30% of the second year winners.

  Two different groups of Private Sector actors have to be considered:

  - The financial and technological potential of *large multinational corporations* makes them attractive partners for local actors. To attract them, the centre must offer attractive research and innovation opportunities and access to regional research potentials.
  - *SMEs* can benefit particularly from a participation in the centre for the development of their research and technological competencies. Regional clusters offer them access to an extended knowledge pool and research infrastructure with state-of-the-art equipment. This is beneficial for strengthening regionally important sectors.

  Therefore it is important that consortia are open for new collaborators with a high own research potential or with a specific need to be involved in state-of-the-art research. However, this creates another challenge: Centres must find a sound balance between this openness to achieve spill-over effects and the need to develop leading-edge research competencies to be attractive magnets for top-level research partners and to create sustainable competitive advantage. This may impose limitations for the centres' capability to broaden their regional impact.

- *Development of university organisations*

  In their first years of operation, the centres have created a strong momentum to accelerate the modernisation of universities, including the development of their research compe-

tencies, organisational reforms and the orientation towards the transfer of research results and scientific knowledge. In this sense, the impact of the Private Sector partners in the consortia has reinforced the pressure coming from research policy makers through new legislation and regulations. Through these combined effects, universities were motivated to put the new regulations into practice rapidly and consequently. At the same time, enhanced new regulations, e.g. on university patents and efficient new technology transfer mechanisms, have contributed to making the centres more attractive and to remove barriers for their efficient functioning.

- *Advanced research*

  Through the encouragement of interdisciplinary and trans-disciplinary research, the centres have also contributed to overcome the traditional shortcomings of university research in isolated disciplines. Collaboration between various departments of the involved universities is encouraged and incentives are created to enhance activities beyond the traditional teaching and research focus towards a 'third mission' of creating value for society through transfer of knowledge and research results. At the same time, the introduction of modern collaborative working methods and of a new performance evaluation system is accelerated and a new spirit is fostered in universities.

- *Sustainability*

  After the ramp-up period of the centres, participants expressed a growing need for an enhanced formal framework for their durable long-term collaboration. Since they do not have a status as legal entities, the centres can for example not participate in tenders for research projects. According to participants, filing such applications through the centres' academic parent organisations or through Private Sector partners is not a satisfactory solution. This growing pressure to introduce an upgraded organisational collaboration framework is a sign for the high interest of the involved Private Sector enterprises.

- *Regional development*

  The intellectual potential, research and educational activities and new technology/ business incubation function of the centres can become an important element of their region's economic development. As technologically attractive 'magnets', they attract innovative enterprises, thus contributing to strengthening the region's competency and resource pool. At the same time, they can play a vital role in the development of the technological capabilities of regional SMEs through collaborative research, the transfer of knowledge and the education of highly skilled staff.

  But the successful development of such centres requires a favourable environment. There must be a critical mass of academic research potential and of technology-oriented enterprises. And there must be a supportive overall policy framework: Economic, education, tax and other policy domains must support the technology-driven development path for which the centres stand.

Case Study Hungary Appendix 1: Additional important literature and information[177]

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www.szjt.hu	Szentágothai Knowledge Centre (Password required)
www.it2.bme.hu	Információtechnológiai Innovációs és Tudásközpont, (IT) 2

[177] For basic information already quoted, please refer to the country report for Hungary in this study.

Documents

- 2003 Act No XC. of 2003 on Research and Technological Innovation Fund
- 2005 Act CXXXIX of 2005 on Research and Development and Technological Innovation (short name: Hungarian Innovation Act)
- 1993 ACT LXXX of 1993 on Higher Education
- 2005 Law on Higher Education
- Different documents of the Szentágothai Knowledge Centre
- 2004. d) Research and development in Hungary 2003-2004 (Working Paper available on http://www.nkth.gov.hu/main.php?folderID=466&articleID=3653&ctag=articlelist&iid=1
- GKM 2003 Technological development and Innovation Programme, 2003, April

Case Study Hungary, Appendix 2: Szentágothai Knowledge Centre (SzKC) as an example for a successful regional initiative

This Centre was one of the winners of the first call. It was established in 2004 by three scientific organisations, one large and four small Private Sector enterprises. The founding organizations had collaborated previously to re-channel and broaden their research. Their shared objective in the fall of 2003 was to fundamentally transform the university's research approach from an overly academic and publication-oriented attitude towards a seamless research and innovation chain which takes scientific results directly to the various forms of commercial utilisation.

In the spring of 2004, the participants signed a Letter of Intent to form a Consortium and initiated first steps for the establishment of an innovation centre and scientific park at an international standard - the BIMIP (Bio-Info-Medical Innovation Park). In July 2004, the president of the *Semmelweis University* Council, the leading organisation of the consortium, initiated an amendment of the University Constitution, allocating 0.5% of the total university budget to the transformation of the R&D process. At the same time, plan emerged to establish a Technology Transfer Office as an independent business entity owned by the university. It would be responsible for the commercialisation of the university's intellectual potential.

But this strategic plan was jeopardised by a shortage of financial resources. The new Regional University Knowledge Centre programme was launched just in time to prevent stagnation of the ambitious project.

The founding members of the consortium beside the host, *Semmelweis University* were:

- The *Information Technology (IT) faculty of Pázmány Péter University* from the same region. This young faculty (launched in 2001) has a high competency in IT research and education and has established itself as a recognised actor in the field of natural and artificial recognition and sensing in conjunction with neurosciences and introductory physiological knowledge. The IT faculty operates the Jedlik R&D Laboratory. Its operations are supported by four academic institutions (SZTAKI, KOKI, MFA, and PKI).
- Another scientific founding member, *MTA Experimental Medical-science Research Institute* (MTA KOKI) is the exclusive medical-biological research site in Hungary. Its main activity consists of multidisciplinary neuroscience research.
- Hungary's enterprise with the highest rate of R&D spending (8% of revenues), the pharmaceutical company *Richter Gedeon SHC* is among the initiators of the Centre and a founding member. The company's own R&D organization works with a staff of over 700 in drug development.
- Four small companies are also among the founders:
  - *KPS Biotechnology Ltd.* (established 2003) is the first bio-technological spin-off enterprise connected to the Semmelweis University. It obtained a 'start-up' state grant for developing gene-therapy and cell-therapy technologies.
  - *Analogic Computers Ltd.* (established in 2000) is a spin off company of the Analogic and Neural Laboratory of the MTA-SZTAKI (Hungarian Academy of Sciences – IT and Automation). This laboratory's internationally recognised scientists and research & development engineering group have been active in Cellular Network research and development in the past ten years.
  - As an SME, *MorphoLogic Ltd.* (established in 1991) has had already considerable commercial success, for example with its spell-checking program integrated in the Microsoft Office software. The company is exclusively active in computer-based linguistic research (speech recognition, text reading, mechanic translating technology and sentence analysing technology).

- 3DHISTECH Ltd (established in 1992) had reoriented its core activity from trading to medical device development in 1996. The company developed an automatic object-slide digitalising system and a related program pack consisting of a pathologic data-base management system, object-slide digitalising software, a virtual microscope program pack and tele-consulting programs.

Besides the consortium members, several other enterprises supported the development of the centre and participate in the 4- and 10-year strategic concepts worked out by the consortium. These include four businesses enterprises (Philips Hungary Ltd – Medical department, IBM Hungary Ltd – Life sciences department, Proactive Management Consulting, PMC 2002 Ltd., RÉV 8 /Futureal (Corvin-Szigony) Ingatlanfejlesztő SHCo.), three academic institutes (MTA – SZTAKI, National Nerve-surgery scientific institute, Gottsegen National Cardiology Institute) and the Budapest Local Government of district #8.

The aims of the Consortium were

(1) to transform the university's research activity fundamentally. The most important element is a new vision of a university research process that adopts a seamless innovation chain resulting in various forms of commercial utilisation of research results (including patent, licences, royalty, spin-off and start-up);

(2) to identify synergies in relevant scientific fields and to stimulate a multidisciplinary research approach leading to innovative novel products and services;

(3) to rapidly found and build the Technology Transfer Office at the university leading the consortium;

(4) to develop a 'core facility' entity; and

(5) to invest massively in the necessary infrastructure and in the incubator in order to host spin-off and start-up companies on an international standard.

An important underlying objective was the rapid change of the traditional, academic attitude towards business-oriented thinking. For this purpose, a strong emphasis was put on education and on student involvement in research and development to develop their professional, industrial and international skills. This included a Ph.D. course in industrial innovation and innovation management, the transfer of practical experiences and international "best practice" knowledge by recognised industry experts, founders and managers of successful start-up and spin-off companies and other support for career and professional development.

The centre's activities focus on interdisciplinary research at the interface between biological and IT sciences at the forefront of scientific progress. In this area, the SzKC has 5 coherent programs focusing on drug development, individual genetic medication therapies, exploration of predictive genetic patterns for the prevention of cancer and diseases of civilisation and screening of such diseases, creation of diagnostic methods and instruments and information processes encompassing the therapy process, and a broader industrial introduction of info-bionic instruments and bionic prostheses. Targeted R&D activities focus on projects with a high application potential which utilise synergies between consortium partners. This provides also a further impetus for co-operation with industry experts, postdoctoral researchers, Ph.D. students and university researchers in R&D projects organised by the SzKC.

Co-operation is based on joint research & development and innovation activities involving the regional Public and Private Sector actors. This collaborative research is supported by the university infrastructure, which is extended through investments which are enabled by grants from the Regional University Knowledge Centre programme and by contributions of the consortium partners. Beyond collaborative research, other approaches gain importance for bridging the academic sector with the business sector, e.g. licence sales, royalty contracts, start-up and spin-off activities.

Another challenge for the development of the centre is its geographical dispersion. Today, it is spread out over several locations without a 'common roof' and a modern R&D infrastructure which ensures the necessary concentration and integration of resources and intellectual potential. As a prerequisite for participating in international R&D networks, EU-sponsored research programmes, etc., the centre needs a state-of-the-art infrastructure at international standards. However, this fifth aim of the centre is not supported by the Pázmány Péter programme, because infrastructure investments are not compatible with its principles. A possible solution for this problem could come from synergies with another governmental program, the *Regional Operative Program of Central Hungary* (ROPCH), which focuses on support for SMEs to develop the region's knowledge base. Another possible synergy could b with the city restoration program (Corvin-Szigony Project) which would allow significant development of physical infrastructure to offer a common roof in a 21st century research building for various activities of the knowledge centre. The presence of such supporting measures can contribute to the success of the centre concept.

In its first operational year 2005, the SzKC has prepared the foundations for its efficient operation. Methods and mechanisms for collaborative research and a project-oriented operational framework were defined and implemented[178]. This includes criteria for monitoring and performance evaluation of researchers and programmes. Evaluations take place regularly in defined time periods, for example at project milestones or before significant career steps. Project managers are responsible for the performance of their projects.

The Centre launched 3 new Ph.D. courses for medical and IT students on industrial property rights, on science and project management and on national and international bidding systems. 0 graduate students, 8 PhD students and 25 young researchers were involved in the numerous research activities of the centre. In the course of these activities, an international project was launched, five articles were published in international journals, and 15 new research jobs were created.

[178] Resulting for example in two publications Regulation of Intellectual Property and Handbook for Operations