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Workshop Proceedings
Brussels, 25-26 September 2007

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Foreword

In September 2008, the European Commission published a Communication outlining its new strategy for international co-operation.[1] This outlines a framework for a European approach to international co-operation in science and technology. In particular, it outlines core principles that should underpin European co-operation with the rest of the world and proposes specific orientations for action. These are designed to:

- Strengthen the international dimension of the European Research Area (ERA) by integrating Europe's neighbours into the ERA and fostering strategic co-operation with key third countries through geographic and thematic targeting;
- Improve the framework conditions for international co-operation in science and technology and for the promotion of European technologies worldwide.

The Communication is one of five policy initiatives launched by the Commission as a follow up to the 2007 Green Paper 'The European Research Area: New Perspectives'.[2] After this was published, a widespread consultation exercise was launched and a series of Expert Groups set up to explore policy options. One of these focused on international collaboration, publishing its independent report ('Opening to the world: International Co-operation in Science and Technology'[3]) in July 2008.

The workshop on which this report is based informed both the work of this Expert Group and the Commission's preparations for its Communication on international co-operation. Held in Brussels on 25-26th September 2007, it focused on the topic of 'Research Priority Setting for International S&T Co-operation'. Twenty speakers and discussants from EU Member States and partner countries were invited to speak and reflect both on their experiences of priority setting for international co-operation and the mechanisms and processes needed to improve the identification, establishment and modification of priorities. A full list of the topics covered and the invited speakers and discussants is provided in Appendix 1.

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[1] See http://ec.europa.eu/research/press/2008/pdf/com_2008_588_en.pdf

[2] See http://ec.europa.eu/research/era/consultation-era_en.html#greenpaper

[3] See http://ec.europa.eu/research/era/pdf/eg6-international-cooperation_en.pdf

This report comprises a summary of the discussions at the workshop (see Guy) and a selection of some of the individual contributions, specifically those prepared subsequently by authors to complement oral contributions and slideshows presented at the meeting itself. These include coverage of the main conclusions relevant to priority setting of the CREST OMC Expert Group on the Internationalisation of R&D[4] (see Schuch) and discussions of priority setting in both EU contexts (see Marklund and Dachs) and partner countries (see Harayama, Hassan-Wassef and Husted).

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[4] See CREST (2008), 'Internationalisation of R&D: Facing the Challenge of Globalisation – Approaches to a Proactive International Policy in S&T' at http://ec.europa.eu/invest-in-research/coordination/coordination01_en.htm

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Reflections on the Workshop

Ken Guy, Wise Guys Ltd., UK

1. Introduction

1.1 Objective of the Workshop

In the context of a review of policies capable of realising the European Research Area (ERA), the workshop set out to reflect on international S&T co-operation, focusing in particular on the feasibility of establishing priority setting processes and mechanisms for such activities. This included the establishment of appropriate mechanisms both within the European Commission (where international S&T co-operation is a high-level priority but is implemented in a heterogeneous fashion across different parts of the Framework Programme) and in national settings (where international co-operation can sometimes be a high-level priority in itself but is, on other occasions, the *ad hoc* outcome of activities that involve S&T co-operation but do not prioritise it).

1.2 Definition of International Co-operation

All forms of S&T co-operation involving the EU and/or EU Member States fell within the scope of the workshop. This included co-operation between Member States and co-operation with major competitors (e.g. the US and Japan); with large, rapidly expanding economies (e.g. China and India); with near neighbour countries (e.g. countries in the Mediterranean basin); and with developing countries elsewhere in the world. The intention, however, was for the focus to be on EU/non-EU co-operations rather than EU/EU co-operations.

1.3 Workshop Structure

The structure of the workshop was quite simple.[5] After an introductory session looking at the reasons why international co-operation occurs and some of the barriers preventing it from happening, a series of speakers concentrated on the ways priorities for international collaboration are set in different contexts (research institutes with international co-operation as part of their remit; national policy environments; ERA-Nets focusing specifically on international co-operation; Technology Platforms). After a discussion session aimed at distilling the lessons to be learnt from these experiences, the focus shifted to a series of presentations on the functional steps involved in priority setting, namely:

- Identifying topics and priorities;
- Balancing selection criteria and establishing priorities;

[5] See Appendix 1 for the agenda and participants.

- Modifying priorities in the light of changing circumstances.

After another discussion focusing on the ways policymakers in different national settings might respond to a high-level imperative to increase levels of international collaboration, the next session invited speakers from non-EU countries to discuss their reasons for collaborating with European partners. A final session attempted to distil some of the major points to emerge from the meeting.

1.4 Reflections on the Workshop

Like all good brainstorming sessions, the rich and variegated discussions soon broke free of the confines of the workshop structure and any attempt to squeeze them back into this framework in these reflections would be fruitless. So too, however, would be any attempt at a liberal transcription, because this would obscure some of the themes which came to underpin and permeate the discussions.

Most of the interchanges need to be located within one of two main scenarios. In the first, international co-ordination is not in itself a high-level priority but does occur as the result of *ad hoc* decisions taken at a multiplicity of lower levels within the research system, e.g. by researchers themselves or by programme managers deciding that particular projects would benefit from the involvement of foreign researchers. In this scenario, the main topics of interest tend to revolve around how 'lower-level' actors can persuade 'higher-level' actors of the importance of international collaboration and the need to increase the priority attached to it. Let us call this the Bottom-up Scenario.

In the opposing Top-down Scenario, high-level policymakers do appreciate, for various reasons, that international co-operation is not only desirable but is a policy imperative. The emphasis, here, therefore is on the steps high-level policymakers need to take if they are to ensure that international co-operation becomes an integral part of their S&T policy implementation strategies.

2. The Bottom-up Scenario

The most important needs within this scenario are for the various 'lower-level' actors to identify and articulate the motives for international co-operation as they perceive them; to develop the rationales underpinning support for such activities; and to communicate these to 'higher-level' actors in an effort to persuade them of the need to support international co-operation.

These underpinning motives and rationales are different for various actors at different levels within the overall system.

2.1 Motivations for Researchers

For researchers in general, the over-riding rationale for participation in any publicly funded research initiative is access to funding that will allow them to pursue their own research agendas (funding and knowledge motives). When these activities involve collaboration (including international collaboration), the motive is to 'add value' via access to complementary expertise and the opportunity to work with 'peers' and 'super-peers' (i.e. leading-edge researchers), or to gain access to research infrastructures that are normally out of reach.

2.2 Motivations for Institutions

At an institutional level, the motive for firms to participate in international agendas is not only access to complementary scientific and technological expertise, but also the desire to pursue broader 'globalisation' agendas involving improved access to resources and markets. Cost reduction, risk sharing and the need for greater control over spillovers are also important motives for collaboration. For universities and research institutes, too, the manifold needs to improve performance, to compete internationally, to perform new roles and to form new alliances in a changing global context are again motives for international co-operation.

2.3 Motivations at the National Level

At a national policy level, the rationales for international collaboration have been poorly articulated historically and supportive policies often weakly implemented, though there are signs that this is changing. International collaboration is often primarily the result of the ad hoc activities of researchers themselves, with policy rhetoric reflecting the stance that researchers are welcome to collaborate if they so wish and that no barriers will be put in their way. In many instances, however, there are very real but often hidden barriers involving funding, mobility and regulatory restrictions.

Many countries both within and outside the EU are beginning to prioritise international R&D co-operation. In New Zealand, for example, it is possible to track how an early emphasis on S&T agreements enabling scientists to engage in 'bottom-up' collaborations with other scientists in these countries has shifted to more proactive 'top-down' attempts to facilitate co-operation in strategically important S&T areas, including areas of national strength outside the normal set of 'usual suspects' (ICT, biotechnology, nanotechnology etc.).

In Japan, S&T policy since 1995 has put an increasing emphasis on international co-operation, the development of worldwide competition and collaboration and the development of a global innovation ecosystem. Numerous bilateral and multilateral S&T agreements have been signed and one with the EU is being negotiated. The motives in this instance are access to researchers; access to large-scale, advanced R&D projects, facilities and infrastructures; involvement in standardisation and regulation discussions and developments; and the search for partners to tackle global problems. In other words, the motives span access to complementary assets; involvement in the development of important global frameworks; and the pooling of resources to tackle problems too large for any one country to tackle alone (i.e. the classic problem of indivisibility).

There is also a new focus on 'S&T Diplomacy', i.e. the strengthening of S&T co-operation with developing countries, especially those in Africa. This encourages co-operation in areas such as environmental control, water management and the control of infectious diseases. Motives here include the development of outlets for Japanese technology in all these areas.

Recent work by the CREST OMC Group on the Internationalisation of R&D, supports the view that the motives for international collaboration are being increasingly recognised in national policy circles. These motives involve:

- The need to strengthen research excellence and innovation performance through better access to foreign sources of knowledge and increased global co-operation to develop and exploit this knowledge;
- The need to work together with a limited number of other countries to tackle problems of indivisibility, i.e. topics and problems that are too big to tackle alone (many 'big science' initiatives fall into this category);
- The need to work with multiple countries to tackle problems of a truly global nature (e.g. climate change);
- The need to respond to political imperatives and ambitions, e.g. via collaboration designed, in the long run, to strengthen the socio-economic performance of near neighbour countries (sometimes to reduce the potential for immigration), or to encourage the development of potential new markets in more distant regions.

2.4 Motivations at the EU Level

The same motives are also recognised at an EU level, with the additional perspective that the EU as a whole would benefit from the development of 'one voice' in order to optimise the potential benefits from international collaboration by reducing duplication and creating synergies. A more coherent approach to international collaboration would also fit with the drive to establish a truly European Research Area, and the development of a strong EU stance on international collaboration would additionally help to stimulate and catalyse the development of coherent stances and activities within Member States. One view expressed in the workshop was that international co-operation would always remain a marginal concern of national policymakers unless the EU took a lead in emphasising its current and future importance.

2.5 The Role of Foresight and Stakeholder Consultations

Ideally, the motives for international co-operation amongst different actors at different levels need to be reflected in the high-level rationales for international co-operation at national and EU levels. Mechanisms capable of facilitating this generally involve consultative procedures and a shift towards greater stakeholder involvement in policy formulation processes. Foresight mechanisms offer one way forward. These allow the needs of different audiences to feed into the formation of shared visions for the future and increase the sense of collective ownership in policies designed to realise these visions. Priority setting would be easy if we were certain about the future, but unfortunately this isn't the case and foresight offers a way of helping us scope and cope with uncertainty.

Inclusive mechanisms that take into account the views and needs of multiple interest communities are important because the needs of individual communities are often in conflict with each other. One view put forward during the workshop, for example, was that policies for international co-operation should primarily reflect the needs of the research community. It was also pointed out, however, that most researchers prefer to be involved in national rather than international collaborative ventures and in co-operations with partners from whom they can learn, rather than with partners hoping to learn from them. Support primarily aimed at fulfilling these needs would, therefore, rule out much international co-operation, particularly co-operation with partners in developing countries, whereas support aimed at fulfilling the political agendas of other actors would prioritise co-operation of this nature. The over-riding need, therefore, is to establish mechanisms capable of eliciting and incorporating multiple competing needs into the articulation of shared visions.

Priorities set at the highest levels dictate policies that affect people at all levels. It is important, therefore, to involve multiple levels in priority-setting exercises in order to ensure 'buy-in' and acceptance. Establishing shared visions and consolidated rationales via the application of bottom-up processes is also important because these constitute the launching pad for the subsequent top-down phase of priority setting, the formulation of sound policies with well articulated objectives and the evolution of clearly specified modes of implementation.

3. The Top-down Scenario

In this scenario, which presumes that high-level actors have internalised the motives and rationales for international S&T collaboration, the focus shifts to the ways in which 'high-level' actors need to articulate and communicate their priorities concerning the desired types and levels of international S&T co-operation to 'low-level' actors. In particular, the spotlight falls upon:

- The **identification** of:
  - Potential S&T areas in which to co-operate
  - Different potential partner countries
  - Different S&T partners within these countries
  - The S&T co-operation needs in potential partner countries
  - Barriers to international co-operation
  - Ways of lowering or removing these barriers
- The choice of alternative **mechanisms** capable of promoting and implementing S&T co-operation (e.g. support for specific research institutions, R&D programmes, networks or platforms charged with spending a particular proportion of their budgets on international co-operation versus support for research institutions, R&D programmes etc. specifically dedicated to international co-operation)
- The **processes** used within particular mechanisms to prioritise choices capable of satisfying both the priorities of 'high-level' actors concerning international S&T co-operation and the needs of 'low-level' actors, particularly researchers
- The **infrastructural elements** that have to be in place to ensure that the overall system is flexible enough to be alert to, and respond to, fresh signals concerning the changing needs for international S&T co-operation

3.1 The Identification Phase

The crucial ingredient in the 'identification' phase is a sound source of strategic intelligence. This is imperative in order to identify both one's own strengths and weaknesses and those of potential partners. It is also needed to identify threats and opportunities, both singular and collective. Some countries are blessed with extremely competent 'strategic intelligence systems'. Others are not. In turn this raises the issue of when it is appropriate to share such intelligence with other countries, especially when contemplating scientific and technological activities that involve international co-operation. Here the key issue is 'competition' versus 'collaboration'. In many instances, the need for countries to maintain a competitive advantage over other countries will pre-empt any sharing of strategic intelligence. When there is a need to tackle global problems requiring international co-operation, however, this imperative wanes and the need to share intelligence inevitably waxes. This is also paralleled when the advantages of operating at a collective (e.g. EU) level are readily apparent (e.g. when presenting a united front to other political power blocs is in the national interest).

Foresight is a useful tool for the exploration of shared priorities when used by a self-selected group of countries (e.g. within the context of ERA-Nets – see later). In particular, it is a useful way of exploring both capabilities within these countries and needs. It can also be used as a way of identifying additional potential partner countries, based on a sharing of the experiences and knowledge of the group members. It is less useful as a tool to identify potential partners when used within a single country to tap the knowledge bases of indigenous researchers, though its utility would increase if used at a European level to tap into the variegated experiences of researchers across the whole EU.

There is a demonstrative need to foster a foresight culture internationally, and this can best be done via international collaboration. This would need to focus on on-going training for newcomers; mutual learning amongst practitioners via conferences, the production of foresight guidance manuals; benchmarking exercises; and 'hands-on' learning via joint foresight exercises.

The 'identification' phase in priority setting for international collaboration is crucially dependent on the availability of data. In terms of the identification of potential partners, 'indicator' data on the strengths and weaknesses of potential partners in specific science and technology areas is an obvious imperative. So too, however, is generic data on research and innovation policy developments in these countries, and specific data on their own needs regarding international science and technology collaboration.

In the EU, the ERAWATCH and INNO-POLICY TRENDCHART initiatives provide such data on research and innovation policy developments respectively. These 'policy databases' initially focused on policy developments in EU Member States, but recently they have been expanded to cover developments in a growing number of other countries – both highly developed economies and rapidly expanding economies. In future, it is to be hoped that they can expand to cover developments in many other developing countries as well (plus contact details for relevant ministries and key research organisations). From the point of international co-operation, it would also be useful if they could collect data specifically on science and technology agreements between different countries and policy stances concerning international co-operation per se.

Databases such as ERAWATCH and INNO-POLICY TRENDCHART would also benefit from a greater focus on policy initiatives initiated by regional authorities rather than national, given that many of these initiatives are highly innovative in nature. This could be of specific interest in the context of international co-operation given the potential for individual countries within Europe to collaborate with specific regions of comparable size within much larger economies (e.g. within China and India).

All attempts to establish priorities for international co-operation need to be accompanied by efforts to identify the motives for international co-operation in potential partner countries. There also needs to be a keen understanding of what needs to be in place if co-operation with a particular partner country is to work. In developing countries, this can often involve external assistance designed to build up internal strategic intelligence and priority setting capabilities, in order to allow the partner countries to fully appreciate the benefits of co-operation. This can involve efforts to introduce foresight mechanisms into planning processes, help with the design of strategic intelligence systems, and monitoring and evaluation systems to assess the benefits of co-operation.

3.2 Devolving Responsibility for Priority Setting via Target Setting

Policy administrations bent on raising the level of international co-operation can take a variety of routes. Some routes call for priority setting (in terms of countries to work with and technological areas to work in) to be carried out at a high-level, with political motives determining the partner countries of choice; broad consultative mechanisms suggesting the technology areas to work in; and multi-lateral S&T agreements providing the framework for joint activities. Other routes, however, can circumvent the need for high-level priority setting mechanisms (or complement them) by transferring the onus of priority setting down to an operational level.

One such mechanism involves specifying international collaboration as part of the mission of public sector research institutions and setting targets for international collaboration within these organisations. One example is the EU's Joint Research Centre (JRC). The overall aim of the JRC is to provide customer-driven support for the conception, development, implementation and monitoring of EU policies. Since many EU S&T policies have an international/global dimension, however, there is also an implicit obligation to be involved in scientific collaborations with both EU and non-EU countries if the JRC is to perform this function. Involvement in international collaboration also raises the profile of the institution and helps strengthen the voice of the EU internationally. Making the need to be involved in international co-operations an explicit part of the JRC's mission and setting targets for levels of co-operation with non-EU countries are thus ways of ensuring that the overall mission of the JRC is fulfilled. In practice this involves the institution specifying priority countries, mapping these onto its priority S&T areas, and using a variety of instruments (institutional networks, collaboration agreements, indirect actions etc.) to involve partners from multiple countries in research-related activities.

Setting targets for the involvement of partners from different countries can also be applied at national and EU R&D programme levels as well as at an institutional level, with framework conditions allowing the participation of 'foreign' participants (in the case of national programmes) and 'non-EU' participants (in the case of EU programmes), and targets in place to encourage the desired levels of international collaboration. Attempts to meet these targets then depend on efforts to persuade potential participants to submit proposals that involve international partners and selection criteria and processes that favour such participations (though not at the expense of research excellence).

3.3 Devolving Responsibility via Joint Programmes

As an alternative to the specification of targets for the participation of participants from multiple countries to be involved in national programmes, joint programmes sponsored by multiple countries can also be launched. The current ERA-Net scheme in the EU primarily encourages 'variable geometry' groupings of EU countries to co-fund joint activities, calls and programmes. Generally these do not involve participants from outside the constituent Member State countries, but some are deliberately constituted to foster broader international collaboration. Within these, the four-step ERA-Net process allows for:

- The systematic exchange of information and good practices on existing programmes and activities;
- The identification and analysis of common strategic issues;
- The planning and development of joint activities between national and regional programmes;
- The implementation of joint trans-national activities, including joint calls and programmes.

Options for priority setting within these schemes variously involve:

- Top-down decisions by the funding agencies;
- Bottom-up expressions of interest from proposers;
- Mixed top-down, bottom-up processes involving the specification of broad S&T themes after consultation with the scientific community and the selection of bottom-up proposals broadly in alignment with these themes.

Priority setting workshops are an important element in the ERA-Net process. Initial preparation is needed to clarify objectives and expected outcomes, to select participants from several countries and to formulate detailed agendas for the workshops. Discussions within the workshops then focus on the criteria for priority setting (scientific, political, economic etc.); the selection of priorities from amongst a number of alternatives; and the choice of appropriate instruments and policy mechanisms to achieve overall objectives.

3.4 Priority Setting within Technology Platforms

EU initiatives such as Technology Platforms are designed to encourage industrial partners to collaborate in the process of identifying and assessing research options for the future and producing shared visions and research agendas, either to be pursued individually or collectively via various private, public and private-public partnership routes. Some of these focus on ways of tackling global problems, where widespread international collaboration is frequently needed. In these, the extent of international collaboration can be influenced by the extent to which communities in different parts of the world care about the problem; by the possibility of maximising the global impact of research via the widespread involvement of partners from different countries; and by the extent to which competitiveness issues between the partners in different countries can be managed.

In reality, however, existing schemes tackling global problems that involve participants from EU countries have to overcome particular problems and barriers when attempting to incorporate participants from developing countries. The need for their inclusion is apparent from the global nature of the problems tackled, but their ability to participate fully is often constrained by the lack of availability of financial resources and skilled personnel. Adequate IPR arrangements also have to be in place, as well as agreements about market access.

3.5 Priority Setting Processes and Criteria

Priority setting involves not only the identification of different priorities but also the establishment of criteria allowing choices to be made between competing priorities. Typically these criteria reflect the motives underpinning the need for international co-operation within different sections of the community. One case discussed in the workshop involved the elements involved in prioritisation decisions concerning the public funding of R&D in Sweden. Here there is a need to balance the needs of business (innovation, value generation and international competitive advantage) with those of society (public sector renewal and production; international political relationships) and those of academia (scientific research and knowledge and international competition and co-operation). Moreover, all these have to be weighed up within the context of another balancing act, i.e. the balancing of National, Regional and EU needs.

Priority setting processes and criteria differ radically when considering different types of scientific and technological activity. ‘Big science’ decisions, for example, are governed by considerations of ‘indivisibility’ (the need to pool resources to tackle problems that are bigger than any one country could tackle alone); ‘excellence’ (the need to work with the best researchers in the world’; and ‘global competition’ (the need for particular groups of countries to present a united front against other country groupings).

Policies in support of international co-operation often have to be justified in terms of concepts such as ‘market failure’ and ‘additionality’. For support to be justified in such cases [6], there has to be some evidence that there are barriers to international co-operation that cannot be lowered without public intervention, and that the benefits accruing from international co-operation facilitated by pubic support are likely to be greater than those occurring in the absence of the intervention. Producing such evidence is relatively easy when the target audiences for support policies have little or no experience of international collaboration (e.g. many SMEs), but more difficult when the target audiences are large MNCs with extensive prior experience in international R&D co-operation.

3.6 Establishing a Responsive Priority Setting System

Changes in external circumstances can challenge existing priorities and trigger new priority-setting exercises. Typically threats have a greater mobilising effect than new opportunities. One challenge for R&D and innovation policy is how to raise the profile of exciting new scientific and technological developments to such an extent that they can trigger modifications to existing priorities.

In order to be able to respond adequately to those changes in circumstances that trigger new priority setting exercises, mechanisms need to be in place to ensure the continuous provision of up-to-date strategic intelligence on new opportunities and threats, potential partner countries, barriers to co-operation etc.

Although it is imperative that policy systems are able to respond to new threats and opportunities by modifying priorities concerning international R&D co-operation, rapid priority shifts and changes in the pattern of allocation of funds for research can also be disruptive to the scientific community if these perturb their efforts to follow long-term research agendas by increasing the volatility of funding sources. This puts an onus on policymakers to make sure that sufficient contingency funds are in place to ensure that such disruption is minimised.

[6] N.B. Political priorities can sometimes override such considerations.

Priority Setting In a National Context: Analysis and Conclusions from the CREST OMC Working Group on the Internationalisation of R&D[7]

Klaus Schuch[8], Centre for Social Innovation (ZSI), Austria

1. Mandate

The mandate of the CREST OMC Working Group on the Internationalisation of R&D was to:

- Collect and present Member State (MS) and Associated State (AS)[9] policy approaches to internationalisation of R&D and innovation;
- Identify good practice, pending questions and problems related to the development and implementation of a proactive internationalisation strategy based on national and Community experiences;
- Analyse the lessons learnt from co-ordinated multilateral initiatives like the horizontal ERA-NETs and to develop scenarios for future multilateral approaches of MS based on OMC and building on national and Community instruments;
- Develop recommendations related to the international co-operation dimension in S&T of both MS/AS and, if appropriate, also for Community activities.

2. Drivers

In order to understand the issue of priority setting, it is necessary to identify the drivers of international R&D collaboration. In general, international S&T co-operation is driven by the aims of:

- Strengthening research excellence and innovation performance by a better access to foreign sources of knowledge and by increased global co-operation between research organisations and innovation networks to jointly develop and exploit new knowledge and technologies based upon comparative factor advantages (in terms of knowledge and technologies);

[7] This paper summarises the main findings concerning priority setting of the CREST OMC Working Group on the Internationalisation of R&D. The full text is accessible via the 'Analytical Report on Policy Approaches towards S&T Co-operation with Third Countries', edited on behalf of the CREST OMC Working Group by Jan Nill, Klaus Schuch, Sylvia Schaag-Serger, Jörn Sonnenburg, Peter Teirlinck and Arie van der Zwan.

[8] On behalf of the CREST OMC Working Group on the Internationalisation of R&D.

[9] Member States (MS) of the European Union and other States associated to the European Framework Programme for RTD (AS).

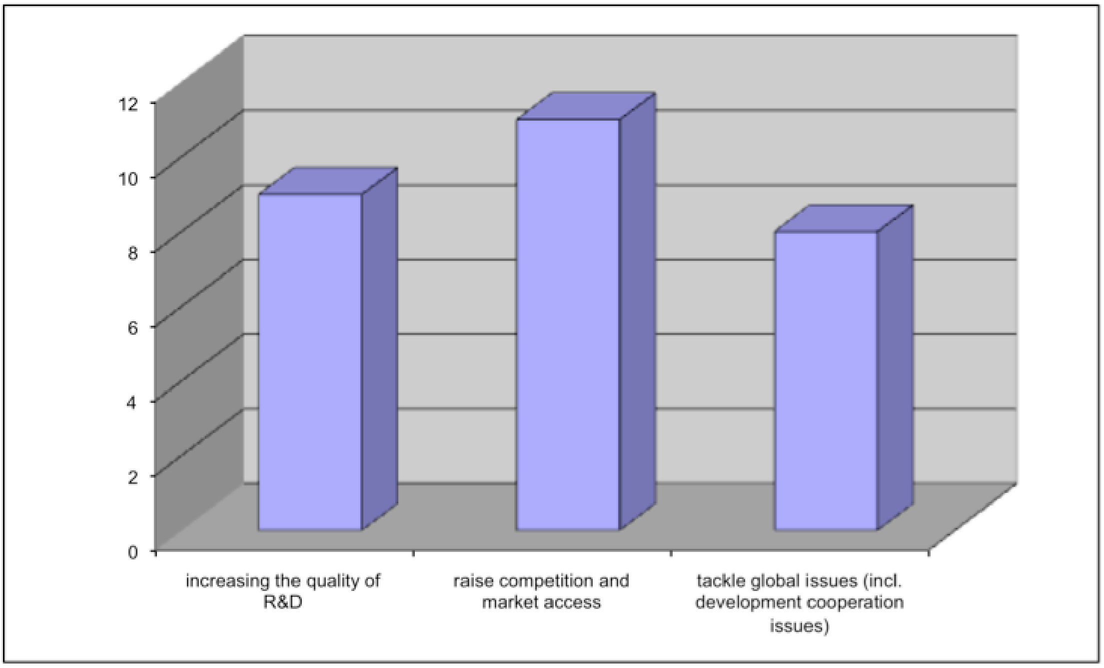
- Increasing the attractiveness of Europe on the worldwide R&D market and to successfully compete for R&D contracts and services, to attract more foreign investments in R&D as well as the best and most creative 'brains';
- Preparing the domestic ground for successful European innovations abroad;
- Responding to global problems, international commitments and to foster the role of the EU as a community of values.

3. Objectives

As a matter of consequence, the major objectives of MS/AS regarding internationalisation of S&T towards third countries can be subsumed under three bullet points (see Fig. 1):

- The objective to increase the quality and absorption capacity of domestic S&T through international S&T partnerships allowing access to foreign knowledge and S&T resources (this subsumes the explicit aim to support 'excellence' but also the less ambitious aim to push-forward the internationalisation of domestic R&D and, thus, to raise the quality and absorption level in general);
- The objective to gain access to new markets and to increase the own innovation system's competitiveness (in this respect internationalisation of S&T is very often perceived as an important complementary approach to other international economic activities);

Figure 1: Major Objectives of Internationalisation of S&T with Third Countries



Source: Policy questionnaire on the internationalisation of R&D – CREST OMC WG on the internationalisation of R&D

- The readiness to engage in solving global problems that cannot be tackled individually in an efficient way by a country alone (in this sense a certain commingling with global development goals deriving from development co-operation, e.g. Millennium Development Goals, can be observed).

It can be roughly summarised that all three dimension have been almost equally perceived as important objectives for the internationalisation of S&T with third countries. Also it turned out that these objectives are not exclusive, as most MS/AS have mixed objectives for their internationalisation policies in the field of S&T. Most priority, however, is addressed to the issue of facilitating access to foreign markets and raising competitiveness.

4. Selecting Partners

The issue of priority setting was specifically discussed along two dimensions: first, selecting priority partner countries and, secondly, selecting priority themes for international R&D co-operation.

In general, criteria for the selection of priority partner countries and respective thematic priorities can be classified along scientific, political, and economic criteria. As regards the identification of partner countries, six selection categories can be distinguished (by rank order):

- Expected scientific benefits including improving quality and excellence;
- Political reasons including solving societal problems and contributing to development goals;
- Gaining access to (new) markets, competition and innovation aspects;
- Human potential (immigration of knowledge workers, brain drain, brain gain and brain circulation);
- Promotional activities for the national science system;
- Geographical, historical, linguistic and cultural ties.

Systematic information gathering on S&T in third countries is an important element for a targeted and effective international S&T collaboration. This is confirmed by the responses of the questionnaire. Most Member States and Associated States (17 of 21 responses) collect information systematically and use a variety of tools for this purpose. The four most frequently mentioned measures are:

- Embassies in third countries;
- Regular bilateral workshops/conferences;
- National liaison offices in third countries and
- Systematic analysis of participation of third countries in European/international programmes.

Co-operation with other European governments in information collection on third countries is not frequently mentioned as already used instrument. Four countries (Belgium, Finland, France and Turkey) in particular highlight this as one of their relevant instruments, albeit with a rather low priority. There are also a range of other measures mentioned which are mostly of a more ad-hoc nature to collect specific information.

Embassies and national liaison offices figure also among those tools that are accorded highest priority. But also other less frequently used measures receive a high priority valuation by those countries which use them, namely affiliates of national R&D institutions in third countries and systematic analysis of project reports from bilateral programmes with third countries.

It should be noted, however, that a lot of countries stressed that many forms of international S&T co-operation were the result of individual contacts between researchers and research organisations, without any government strategy behind it. In some countries, and only recently, this bottom-up process has been complemented by a more strategic top-down process by central governments.

Regarding scientific criteria, MS/AS mentioned the present and future S&T potential in the partner country including the potential for partnerships in high-tech domains, the striving for excellent research on the basis of co-operation with leading R&D centres, benefits for joint participation in FPs and better access to large international research infrastructures.

The main political aspects relate to foreign policies and instruments like bilateral agreements and umbrella agreements which can act as 'opportunities to get windows opened', capacity building in less developed countries, responsibility sharing for global issues and respecting IPR and ethical rules as well as cultural and historic ties. Economic criteria refer to the future growth potential of the partner country reflected through the partner countries position on the various scoreboards (trend chart, global competitiveness report) as an example of a more evidence based approach.

Another selection criterion is the assessment of already existing co-operation relations of research organisations. However, data mining for this issue becomes increasingly difficult due to the increased autonomy and diversity of the involved organisations. Desirable metrics for evidence-based decision-making are not always available and, moreover, existing metrics do not necessarily reflect the current (and expected future) performance of certain countries (such as China or India). Thus, systematic information gathering on S&T in third countries is important.

Across the investigated MS/AS, China (mentioned 16 times) and USA (12 times) are most often mentioned in the CREST questionnaire as priority countries for S&T co-operation, and very often ranked in the listing of the top three priority partners. Many countries mention additionally Japan and the (other) BRIC countries and emerging economies like South Africa as priority countries.

Historical ties are still important in selecting partner countries. This preference is in line with existing research that indicates the importance of geographical, cultural and linguistic proximity as important factors for establishing collaboration. For example, Cyprus identifies Egypt and Israel as priority countries, while France makes a reference towards Maghreb and Austria highlights the importance of Western Balkan countries as co-operation partners.

This pattern is line with patterns found in international research collaborations, scientific co-authorships and academic hyperlink networks10.

The observable diversity of priority third partners beyond China, US and Japan seems also to stem from the influence of a broad range of other than S&T policy fields, which influence the area of internationalisation of S&T towards third countries.

It should however not be forgotten that overall trans-national co-operation seems still dominated by the intra-EU collaboration. When asked to assess the importance of co-operation with different types of third country groups, usually only USA and Japan are considered as equally relevant compared with S&T co-operation with EU partner countries, while the co-operation with other industrialised third countries and developing countries is considered less important in the CREST questionnaire responses.

The INCONET-GRICES[11] survey on bilateral international co-operation shows that there are many bilateral agreements between EU countries and developing countries. If differentiated among main regions France, Spain and Sweden stand out in number of agreements with Latin America and the Caribbean Countries. Intergovernmental S&T co-operation with Asia and the Middle East is frequent in France, Germany, UK, Czech Republic, Hungary and Slovakia. The pattern of S&T co-operation with Africa is different; here France has by far the highest number of agreements. When asked for the top seven third priority partners only, as in the CREST questionnaire, a different pattern emerges. Developing countries beyond BRIC countries and direct neighbours appear usually only among the priority partners if there are strong historical ties, e.g. as between Portugal and some Latin American and African countries.

5. Selecting Themes

The identification of priority themes for S&T co-operation towards priority third countries of the MS/AS revealed some interesting insights.

First, half of the interviewed countries did not consider a thematic prioritisation as really relevant. No explanation was given on this fact, but the bottom-up character of some of the existing programmes might explain this issue at least partially. Another explanation is the rather low degree of specification of scientific themes within bilateral intergovernmental S&T programmes. Therefore it is not surprising, that quite often the answers remained on highly aggregated levels, such as ‘natural sciences’ or ‘life sciences’, which can mean or hide a lot. Therefore, additional analysis on the specific levels of funded projects (e.g. within bilateral intergovernmental S&T agreements) needs to be carried

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[10] See for example Heimeriks and Van den Besselaar, ‘Analysing Hyperlink Networks: the meaning of hyperlink based indicators of knowledge production’, Cybermetrics 10 (2006) 1. Schuch analysed the geographical patterns within FP projects and identified a strong propensity towards neighbourhood relations (‘The Integration of Central Europe into the European System of Research’ by K. Schuch (2005), Wien and Müllheim a.d.R: Guthmann-Peterson.

[11] Funded under FP6.

out. In general, there seems to be also a considerable lack of evidence on the real strongholds of research in some third partner countries.

Secondly, among the countries that provided more specific answers in terms of thematic priorities, in some cases a certain orientation towards the scientific priorities of the partner countries could be detected. This is especially true as regards developing countries. Here, the needs of these countries are quite often explicitly taken into account (e.g. research on food safety of The Netherlands together with Indonesia or Egypt or research on human vaccines between Norway and India).

Thirdly, the thematic range of scientific co-operation with the main partner countries (such as China) is quite broad. In other words, only a few obvious thematic specialisations can be identified. The most evident one is the strong orientation towards S&T co-operation with India in the field of biotechnology.

Last but not least, a few unique specialised cases need to be listed, for instance the obvious co-operation with China in the field of TCM (traditional Chinese medicine). It is also worthwhile to note, that social scientific research has a distinct place in collaboration with (former) transformation countries such as Russia (Austria, The Netherlands) or the West Balkan Countries (Austria), in the field of Earth Sciences with the Russian Federation or in the field of exact sciences (mathematics etc.) with the Ukraine or Russia.

All in all, most widespread is a broad thematic orientation (but not necessarily specialisation) towards biotechnology, medicine and ICT followed by a broad spectrum of engineering sciences, environmental research and food research. Some of these topics seem to provide a certain interface with topics targeted by the Millennium Development Goals.

Modifying Priorities in International S&T Co-operation Focusing on Globalisation and the Changing Needs and Behaviour of Industry

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1. Introduction

Priorities in research and innovation policy are a cornerstone of policies supporting the sustainable economic competitiveness and growth of nations and regions. Particularly, the increasing globalisation, and the sense of urgency associated with it, has brought research and innovation policy to the forefront of national and regional competitiveness and growth strategies of many countries.

The EU and its member states are essentially facing the same challenges of globalisation as other regions and nations of the world. There are however important specificities to the EU challenges. These specificities shape the trajectories for policy options and policy tools that are practically feasible in developing EU-competitiveness in research and innovation.

This paper is will discuss three general policy issues in EU prioritisations related to international S&T competitiveness and co-operation:

- Targeting centres-of-excellence;
- Policy levels in EU research and innovation policy;
- EU policy for international S&T excellence and co-operation;
- Modifying national priorities in international S&T co-operation.

2. Targeting Centres-of-Excellence

Increasing international relationships and competition related to S&T and innovation is at the heart of globalisation. Concentrations of capabilities generally have quite strong geographical dimensions. From a business perspective, the importance of centres of excellence for S&T has increased as the research or science part of business firm R&D tends to decrease and development activities related to innovation and commercialisation tend to increase. This is occurring at a time when the importance and use of science as a basis for technology formation and innovation are increasing.

Both these trends are related to globalisation and increased global competition, which strongly argues for increased specialisation. Localisations of business R&D and innovation increasingly tend to be determined by the most excellent and open environments for advanced research and innovation. Centres-of-excellence for research and innovation has therefore become a key vehicle for nations and regions to attract business firm localisations of knowledge intensive activities.

Policy makers are increasingly focusing on promoting centres of excellence in S&T formation, which, in the context of increasingly global competition, act as attractors for investment. However, despite the policy rhetoric in the EU on global excellence, and the emergence of many new instruments, much remains to be done in terms of prioritising excellence in policies and initiatives both at regional and national levels of member states, but also at the EU policy level.

Within the programmes directly aimed at international excellence, criteria for evaluating excellence ex ante, as well as monitoring and ex post evaluations, often lack focus and rigour. Whether or not global excellence is being effectively targeted and achieved is often not clear because of the scale and scope of excellence, and problems in the benchmarking analysis of actual S&T competitiveness within various fields. Moreover, the impact logics related to the different roles played by policies at different policy levels with the EU and their interrelations are often quite fuzzy and therefore not well understood.

Thorough impact evaluations related to the contributions of S&T and innovation policies and programmes at regional, national and EU-level to S&T centres- of-excellence in the EU are very scarce. However, recent general evaluations and policy perspectives on EU competitiveness policy for science and technology indicate that the focus on global excellence is rather weak (Kok, 2004 and Aho, 2005). This is becoming a major concern in Europe and EU policy seems to gradually redirect attention and measures to S&T excellence within a global perspective.

3. Policy Levels in EU Research and Innovation Policy

Specific policy challenges to the EU, as a general administrative and policy space, is generated by the particular patterns of and relationships between different EU-policy levels. These specific policy challenges are highly relevant to EU S&T and innovation policy. The US has often been put forward as a benchmark for the EU in S&T-performance and S&T-policy. However, a major policy making difference between the EU and the US is that the US is a federation, while the EU is not.

The US federation has a strong concentration of resources and priorities for S&T policy at the federal level. Of the total R&D-funding in the US, federal government was 2006 responsible for 25 percent of the funding, while the corresponding share of state governments was only about 1 percent (NSF, 2007). In the EU, the situation is almost exactly the opposite, where the member states are dominating the public R&D-funding. As open and wide competition is a fundamental driver for excellence and competitiveness, the federation-wide competition for S&T-funding in the US has most certainly been a key factor in spurring US international S&T-leadership. And, as such competition has been heavily based on excellence criteria, funding have tended to flow to a rather limited number of S&T centres-of-excellence. Moreover, these funding patterns have tended to further strengthening patterns of quite uneven S&T capabilities and investments across different states in the USA (NSF, 2007).

In the EU, S&T funding has essentially been considerably less open to a geographically wide and strong competition. Funding may in such a competition setting tend to be allocated also to projects that are less prone to driving global excellence than what would be the case in a wider competitive setting. Moreover, policies to level out differences between different regions in the EU through different regional policy schemes may further have enhanced tendencies to funding less competitive projects.

It should be noted that the EU cannot, and probably should not, aim at becoming a similar policy structure as the US. The EU has to further develop its own policy structure and S&T policy trajectories in ways that are appropriate to its own history and potential. However, in doing that, it has to be clearly recognised that the importance and challenges for international S&T excellence essentially are the same for all regions of the world, regardless of the logics of region-specific policy structures.

International S&T excellence is closely related to international S&T co-operation. Priorities for international S&T co-operation are being modified in most EU-countries, as well as at the EU-level. In modifying priorities for international S&T co-operation in the EU, the lack of understanding of how the S&T-policy of the different EU-policy levels work and interact is seriously hampering the overall policy effectiveness. Unfortunately, the S&T competitiveness impacts of international co-operation within the EU and between EU S&T centres and corresponding S&T centres outside the EU have not been thoroughly evaluated. As a consequence, the individual and combined impacts of R&D-funding in member states and from the EU-commission in generating internationally competitive centres-of-excellence and key international co-operations are insufficiently understood.

Taking a risk of exaggerating somewhat, it seems reasonable to characterise the incentive structures for international S&T co-operation in the EU as having been quite heavily geared towards stimulating S&T co-operation between R&D-performers within the EU and in other parts of the world. The previous Research Framework Programmes in the EU has strongly focussed on R&D networking and R&D performing agents within Europe, rather than on a more global outlook (Ormala, 2005). Moreover, it is questionable whether global excellence has been a strong enough focus in R&D-funding criteria in EU and national R&D-programmes.

4. EU Policy for International S&T Excellence and Co-operation

Modifying the priorities towards increasing stimulation of international S&T excellence would be highly critical to the future S&T competitiveness of the EU. This seems also to be the case with the introduction of the 7th EU framework programme for research, which is not only substantially bigger than ever, but also more targeted towards excellence criteria (Muldur, 2006). However, a key challenge for the EU is what the modification of S&T policies in member states and regions would generate. These funding resources are far bigger, taken together, than the R&D-funding from the EU-commission and will therefore strongly determine the future S&T competitiveness of EU-competitiveness.

The EU-commission has, in different ways, aimed at increasing the policy co-ordination between different policy levels with the EU. One such general measure has been the 'Open Method for Co-ordination' (OMC). Another such measure is the ERA-NET scheme aiming at stimulating policy learning between policymaking bodies in the EU. These horizontal schemes seem to have had important positive effects on EU-wide policy learning and co-operation. However, it is highly unlikely that they have and will, in their current form, have any strong overall impact on the international S&T competitiveness of the EU.

The recent Green Paper on the European Research Area is proposing new perspectives to address issues of S&T excellence and international S&T co-operation in the EU. It targets problems of overcoming the fragmentation of the European research system, as it is seen as a challenge in facing the globalisation of science and technology. It is hard to object to the visions of the future ERA. However, the Green Paper does not ask whether EU today has an adequate set of policy structures and policies that would be effective in fulfilling those visions.

Important questions are not raised explicitly. Some of these are: Are the risks that the EU-commission unintentionally increases the R&D-fragmentation in the EU? How can the EU best exploit the fact that the EU, contrary to the USA, has well developed member state systems and structures for co-operation, priority settings and evaluations? How can these member state strengths be used as a key vehicle for international excellence and international S&T co-operation? Or, is the fact that the EU is not a federation with a strongly co-ordinated continent-based R&D-competition a challenge that argues for a concentration of research funding at the EU-level, in line with the ERC?

An even more serious shortcoming of the Green Paper is that it focuses exclusively on the research part of EU competitiveness challenges, leaving the innovation issues to the 'broad-based innovation strategy'. EU research and innovation policies show clear dividing tendencies. This may become a strong source of, in fact, modifying EU priorities away from a focus on industrial and societal use and competitiveness, which is emphasised in the Treaty. An overall research and innovation policy based on clear impact targets and impact logics similar to that of the USA (ACI 2006) is essentially lacking. For the EU, such an overall strategy would need to provide visions for the future of the roles and weights of EU-level, nation-level and region-level policies.

5. Modifying National Priorities in S&T Co-operation

Taking a member state perspective on priorities for international S&T excellence and international S&T co-operation is important as a highly dominating share of the R&D-funding resources in the EU are national. Taking Sweden as an example, it could be noted that all the major R&D funding agencies in Sweden have established schemes for long-term funding of different kinds of centres of S&T excellence. The pioneering VINNOVA initiative, established in 1995, has been renewed in the form of a ten-year programme called VINN Excellence Centres, which focuses on mission-oriented basic research in co-operations between academic and industrial researchers.

An impact evaluation of the initial initiative, conducted near to the end of its first ten-year term, showed that publicly co-funded basic mission-oriented research performed by academic-industry consortia, had generated economic benefits exceeding the total costs of the programme (Arnold, 2004). However, there are questions to be raised whether the different centre-of-excellence investments are sizeable enough to make a substantial enough impact. And, there are indications that intensified focus on international excellence would need to be developed. Moreover, there are clear indications that strategies and activities for international S&T co-operations with the leading corresponding centres in other countries could be improved.

Despite the policy rhetoric on global excellence, and the emergence of many new instruments, much remains to be done in terms of prioritising excellence in policies and initiatives in Sweden and probably also in several other member states. And, in Sweden, S&T programmes that strongly stimulate international co-operations between Swedish centres-of-excellence and corresponding centres in other countries are largely lacking. The EU framework programme primarily supports such co-operations within Europe. However, world leading centres-of-excellence are not the least to be found in Asia and the US and co-operation with them would be critical for improved and sustained competitiveness of the European S&T centres.

6. Concluding Remarks

EU and EU member states have to focus on international excellence in S&T and innovation. International S&T co-operation is an important vehicle for that. EU S&T policy has to modify policy strategies and measures in order to generate improved synergies between different policy levels; the EU level, the national level and the regional level. Priorities should aim at international excellence and international co-operation, at all levels, but the different roles need to be clarified.

Member state investments are the core, as they strongly dominate the volume of public R&D-investments in Europe. EU-commission policy strategies need to provide considerably clearer impact logic as regards the different instruments and horizontal activities. Otherwise there are risks that EU framework programmes are aggravating the lack of synergies, or co-ordination, in public EU R&D-funding. Particularly, there is need for more developed strategies and policy instruments related to stimulating international co-operation between EU centres-of-excellence with excellent centres in other parts of the world.

National policy strategies in member states would generally need modification both in terms of targeting international frontiers in S&T and innovation and in promoting international co-operations between national centres and the most excellent centres in the world. Other major world regions are already implementing quite radical up scaling of their public investments. A common denominator of these strategies is that international excellence is the unquestionable target and ample stimulation for international co-operation with the world leading centres-of-excellence is available.

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Policy-driven and Corporate-driven Internationalisation of R&D

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1. Introduction

Co-operation in research, development, and innovation by enterprises is a rare event. In his survey of trends in R&D co-operation, John Haagedorn (2002, p. 477) states that "joint R&D by companies is considered by many observers as one of the least expected activities that companies would be willing to share with others". Recent results from Eurostat confirm this judgement. Only 10% of all innovating firms – 4% of the total firm population in the EU27 – co-operate with partners outside of their home countries (EUROSTAT 2007).

Despite – and certainly also because of – these small numbers, international innovation co-operation has become a major issue for social and economic research and policy alike. There are a number of initiatives at the national and EU level to increase the co-operation propensity for enterprises as well as universities.

Besides policy, however, there is another driver towards a higher level of international co-operation. Multinational enterprises (MNEs) increasingly give themselves a more decentralised organisation in R&D and innovation. This contribution will focus on MNEs and non-sponsored agreements as one particular driver of international co-operation. I will discuss the reasons for this corporate-driven internationalisation, its various organisational modes as well as its geographical scope and its relevance for science and technology policy.

2. Corporate-driven International Co-operation

2.1 Motives for Corporate-driven International Co-operation

For a long time, it was assumed that enterprises tend to keep R&D as close as possible to their base in the country (Patel and Pavitt 1999; Narula and Zanfei 2005). If R&D is centralised at the headquarter, enterprises can more easily control and monitor the activities; enterprises can benefit from scale and scope economies in R&D and innovation in the home country; the diffusion of knowledge within the MNE is easier, because exchange is one-way, and only includes knowledge transfer from the parent enterprise to the subsidiaries. Moreover, firms are strongly embedded in the scientific infrastructure of their home national innovation systems.

The view on R&D as an important case of 'non-globalisation' (Patel and Pavitt 1991) is currently shifting. Today, innovation is increasingly the result of cross-border activity involving actors from different countries. Business strategies of MNEs move to a globally dispersed organisation of R&D because their national innovation systems are not able anymore to deliver all necessary knowledge.

Multinational enterprises try to match these requirements with various organisational modes of co-operation. First, there are a growing number of R&D joint ventures ('alliances') between firms of different countries and to co-operation between MNEs and universities across countries (Hagedoorn and Schakenraad 1989; Hagedoorn 2002; Narula 2003).

A second mode of international R&D co-operation is internal co-operation and knowledge transfer between units of the MNE located in different countries (Zanfei 2000; Criscuolo and Narula 2005). This special case of international R&D co-operation has emerged because a globally dispersed organisation of R&D needs constant exchange of knowledge and information. Intra-firm co-operation is assumed to be a major driver of international co-operation. It is, however, not well understood and it is extremely difficult to assess due to its internal nature. From the Community Innovation Survey (EUROSTAT 2007), we know that every second internationally co-operating firm has international co-operation with an enterprises belonging to the same group. Nearly all internationally co-operating foreign-owned firms have intra-firm co-operation. Moreover, patent data show that patents with co-inventors predominantly have only one applicant.

There is little information on the extent to which enterprises belonging to the same enterprise group co-operate in the Framework Programmes (FPs). However, since large multinational enterprises such as Siemens, Alcatel or DaimlerChrysler are also active participants in the FPs, it is very likely that intra-firm co-operation of MNEs also occurs in the FPs.

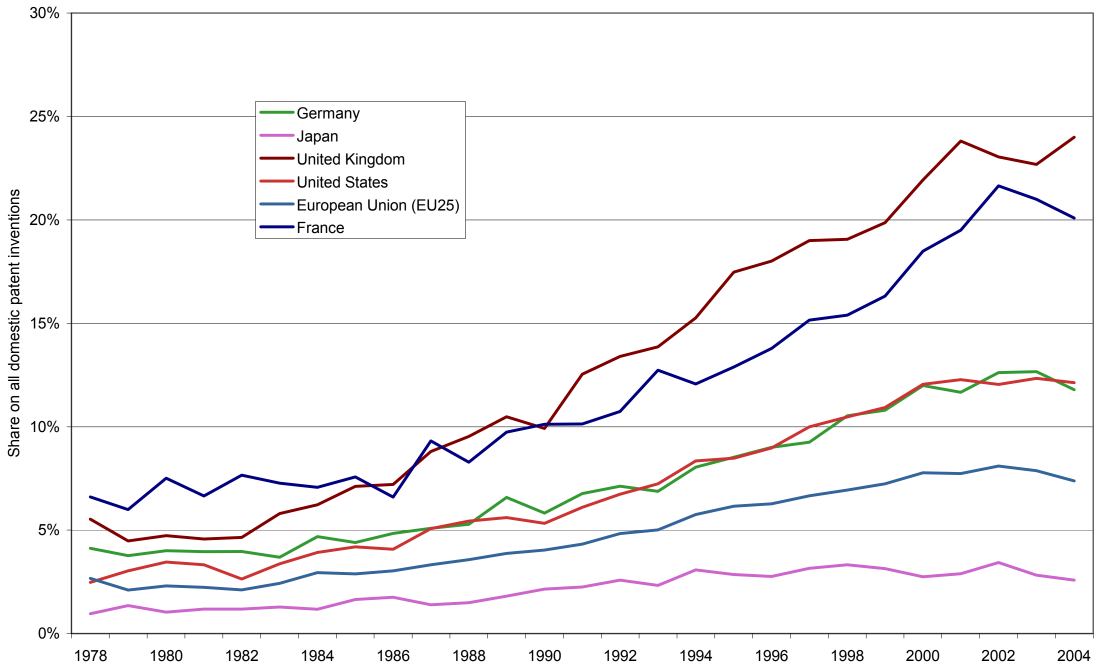
Enterprises pursue for a number of reasons a more decentralised R&D organisation and more international co-operations. On the one hand, the international R&D co-operation is the result of the internationalisation of production and sales of many enterprises. Enterprises require detailed knowledge on foreign markets, culture, regulation, climate etc. to adapt existing technologies and products. R&D units abroad can provide this knowledge and support local production. In this perspective, the internationalisation of R&D is triggered by market needs, a 'by-product' of foreign direct investment and global presence.

The internationalisation of R&D, on the other hand, is fuelled by global knowledge accumulation. Research has shown that knowledge in high-technology areas such as ICT or biotechnology concentrates locally and knowledge spillovers are bounded in space (Breschi and Lissoni 2001; Asheim and Gertler 2005). Enterprises try to capture these localised spillovers from universities, with competitors clustering in local 'hot spots'. Moreover, a number of enterprises have internationalised their R&D activities by integrating the R&D units of foreign-located enterprises they acquired into their corporate R&D organisation.

Other motives for more innovation co-operation include the need to manage rising costs of R&D; the wish to limit the risks of technology development and market acceptance; the wish to create market-wide standards; problems in the protection of knowledge which leads to a second-best solution – enterprises decide to share profits and costs of an innovation with their competitor to avoid copying of their invention (Dachs et al. 2004).

The changing knowledge requirements due to globalisation result in a higher propensity of enterprises for international co-operation. Figure 1 shows the share of patents with at least one foreign co-inventor on all patent inventions of the country at the European Patent Office (EPO) for major industrialised countries. The line for the EU25 in Figure 1 indicates all patents with at least one co-inventor from outside of the European Union.

Figure 1: Share of Patents with at least One Foreign Co-inventor



Source: OECD Patent Database

The degree of internationalisation has increased considerably in all countries with the exception of Japan. Smaller countries not included here, such as Sweden, Ireland or Austria, exhibit even higher levels of internationalisation. The 'old' member states (referred to as EU15), on average, exhibit higher levels of internationalisation compared to the 'new' member states (the EU12).

The rising levels of internationalisation of the EU member states reflect two different developments. We see, on the one hand, a closer integration within the EU, triggered by the common market and Europe's integration in economic, legal, and political terms. On the other hand, there are also stronger linkages between EU members and third countries outside the Union, indicated by the rising values for internationalisation of the EU25 [12].

[12] The OECD has not yet calculated this indicator for the EU27 including Bulgaria and Romania. Since these two countries exhibit only low levels of R&&D internationalisation, we can assume that the EU25 value will very much reflect the EU27 value.

2.2 The Geography of Corporate-driven International Co-operation

An analysis of patent data on international R&D co-operation with respect to the partner countries of EU member states (OECD 2006, pp. 32) reveals the following patterns:

- The current increase of international co-operation in corporate R&D is, at first, a strengthening of the EU15 integration in S&T. The most important partner countries of the EU15 are other EU15 countries. There are very strong ties between Benelux, Germany and Austria, and the Nordic countries. The only two exceptions are UK and Ireland that have stronger ties to the US than to all EU countries. The EU12, on contrary, are only loosely integrated with each other and there are stronger ties between EU12 and EU15 than within EU12 countries;
- The major partner of EU member countries outside of Europe is the US. Data from the European Patent Office show In turn, 8% of all patents invented in the US are owned by residents of the European Union (OECD 2006, p. 33). The outstanding role of the US for Europe – and vice versa - is also supported by data on R&D expenditure and personnel provided by the US National Science Foundation (Jankowski and Moris 2007). According to NSF, R&D performed by US affiliates accounted for 8% of the U.S. industrial R&D expenditures in 1997. The share of US affiliates on spending for basic research was twice as large (16%), which reflects the knowledge-sourcing motive;
- The relationship between the US and the EU is reciprocal and creates mutual benefit. The EU is also the most important partner country of the US in corporate R&D by far. Seven percent of all EPO patents invented inside the EU are owned by residents of the United States. In 1999, 6% of the French, 7% of the German and 15% of all enterprise R&D personnel in the UK worked for US enterprises. It follows that the competitiveness or EU enterprises is based to a considerable degree on technology invented in the US, and the same applies to US enterprises. Even higher values of interrelatedness between the US and the EU can be found if we look at specific technology fields such as information and communication technologies or biotechnologies (OECD 2006, p. 36 and 37);
- The values may be lower when we use data from the US patent office; it nevertheless shows how closely integrated the US and Europe are in science and technology. This view is in sharp contrast to perceptions that identify the US as a major rival of Europe in global struggle in science and technology;
- The role of Asian countries in international R&D co-operation, in contrast, is small. The main drivers of the internationalisation of R&D is NOT the growing S&T capacity of China and India, as can be read in EC documents (European Commission 2007, p. 45). The number of EU patents originating from China and India has increased considerably in recent years, but is still at very low absolute levels. In terms of co-invented patents, countries like Switzerland or Norway excel China and India. This indicates that the considerable R&D investments by EU MNEs in China and India are still very much focussed on local market needs and result in local inventions that not show up in EPO patent statistics so far. Besides a

strategic orientation towards support of local production, this may also be caused by a lower productivity of the science system these countries.

To sum up, empirical analysis shows that innovation is increasingly the result of joint efforts between units of different countries, but is still much more bound to the home countries than production and sales. Only a small fraction of the enterprise population co-operates internationally. Despite the rise of India and China, the main host countries for foreign R&D activity are other EU countries and the US. Asian countries play no role in R&D internationalisation so far. A considerable part of trans-border R&D co-operation takes place between units of the same MNE located in different countries.

3. Implications for EU Priorities in International R&D Co-operation

If multinational enterprises push ahead the internationalisation of R&D, is there a role left for policy? Do we need a designated policy for international co-operation anymore? I will discuss this question with respect to differences in the goals pursued by the FPs and non-sponsored international co-operation, as well as with respect to challenges and opportunities for the FPs arising from the participation of MNEs.

Two main goals of international co-operation for multinational firms are to absorb excellent knowledge abroad not available at home, or support market access with foreign-based R&D activity. These goals are only partly shared by the framework programmes. The FP, of course, aims at excellence as well, but not at market-context knowledge, since its main aim is pre-competitive R&D. This pre-competitive nature may also explain the result of Giarratana and Torrisi (2001) who compared the outcomes of co-operation in the FP vs. non-sponsored alliances. They find that only the latter result in joint patents and conclude that the FP has no impact on technological capabilities of firms.

Another difference in the aims of non-sponsored and FP-sponsored international co-operation is the goal of coherence. EU policies aim to strengthen the capabilities of researchers and organisations in member states with below-average scientific performance ('convergence regions' in FP 7[13]). This is not a goal in non-sponsored co-operation, as can be seen in Figure 2. Here, I have compared the share of EU27 countries and Norway on the total number of co-invented patents and on total participation in the FP 5 (1998-2002). FP5 data has been provided by the EU-funded project NEMO[14].

The goal of coherence is clearly visible in this comparison, with Italy, Greece, Portugal and Spain having larger shares on the FP than on co-invented patents, while Germany, the UK and France being more present in non-sponsored compared to FP-sponsored co-operation through patenting. Moreover, patent

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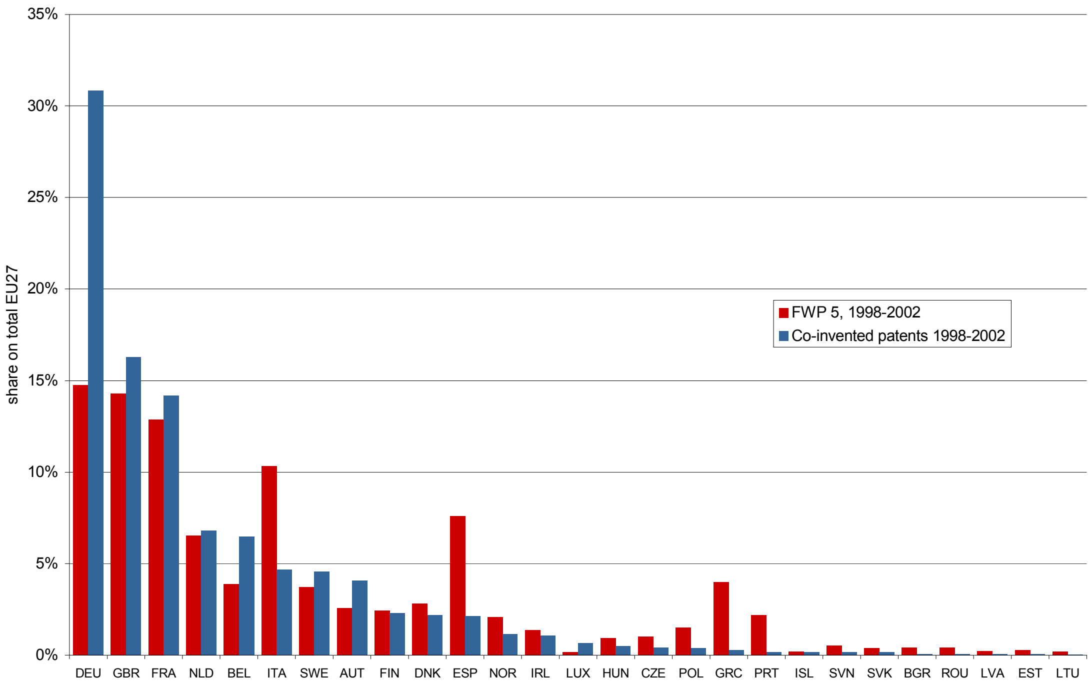
[13] http://cordis.europa.eu/fp7/capacities/convergence-regions_en.html

[14] Network Models, Governance and R&D Collaboration Networks (NEMO), project no. NEST-2006-028875

data shows that the internationalisation of corporate R&D has only strengthened integration in the EU15, and has brought only little integration within EU12.

Figure 2: Co-invented Patents and FWP Project Participations, 1998-2002



Source: CORDIS, data prepared by NEMO; OECD Patent Database.

The rise of co-operation can also be interpreted as an attempt to manage the rising cost of R&D, which often cannot be borne by a single company alone (pharmaceuticals are an example). Enterprises also try to reduce the risks associated with innovation. This includes, for example, the risk of failure in developing a new technology, or the risk of finding no market acceptance for a new product.

Sharing cost and reaching a critical mass is also an important aim in many sponsored co-operation projects such and in the FPs. Risk sharing, however, should be a less relevant motive for FP project, since policy should focus the social rather than the private return for R&D and encourage projects which a higher degree of uncertainty and risk that privately funded R&FD may leave aside.

Moreover, enterprises seek co-operation when they fear they cannot protect their invention from being copied by a competitor. In this case, it is rational to co-operate and share the returns with the competitor, instead of taking the risk of unavoidable knowledge spillovers. Quite the opposite is true for public-sponsored research. R&D co-operation supported by public funds should focus on creating and increasing spillovers - instead of limiting them – to reach to the most wide spread of knowledge in order to ensure high social benefits.

What opportunities and challenges result from this differences in motives between non-sponsored international R&D co-operation and co-operation sponsored by public funds? First, it is obvious that MNEs are key developers of new technologies and can therefore considerably contribute to technological advancements through the FPs. Moreover, SMEs and universities can benefit from co-operation with MNEs in the FPs through knowledge exchange, the exchange of personnel and learning-by-doing. This is important for the training for young scientists particular.

MNEs in the FPs, however, pose also some challenges. There may be a free-riding behaviour of MNEs that try to gain additional funding for research that would be conducted nevertheless and which results in a low degree behavioural additionality. If co-operation partners in the FPs are the same like in non-sponsored co-operation, an additional exchange of knowledge and substantial spillovers cannot be expected. Moreover, since the FPs spend the money of European taxpayers, one should also ensure that investment in R&D can be economically exploited in Europe. In the case of MNEs, which produce globally, it cannot be taken as granted that R&D results are transformed into products and growth in the same country or region.

To sum up, there is a role for policy in promoting international co-operation in applied R&D despite the degree of non-sponsored co-operation. Here, policy should be aware of the tensions between excellence and coherence, because non-sponsored co-operation does not care about cohesion. Moreover, policy should promote the involvement of SMEs in trans-border science-industry linkages and co-operation with MNEs. Since enterprises may be risk-averse and therefore leave out projects with a high social benefit, it should be another goal to promote projects with a high degree of risk that nevertheless promise a large social benefit in case of success. Moreover, international co-operation in research towards societal needs that are out of focus of corporate R&D constitutes another area that requires public support.

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International Co-operation in Japanese Science and Technology Policy

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1. Introduction

With the emergence of a knowledge-based economy, governments in most OECD countries intensified their commitment to the underlying research and development activities. The Japanese government was in line with this trend, setting the objectives of a 'Nation based on the creation science and technology' as the fundamental policy goal, introducing the Science and Technology Basic Law in 1995, and implementing policy packages in the fields of science, technology, industry and higher education.

These policies helped consolidate Japanese science and technology bases, and at the same time 'strategic approaches' became the rule when conducting science and technology policy, starting with a definition of prioritised fields and the reform of institutions related to science and technology, and more recently with the advent of 'Science and technology diplomacy'.

This report will first present an overview of Japanese science and technology policy, then describe briefly the current situation of international science and technology co-operation, and finally focus on the co-operation with the European Union and member states.

2. An Overview of Japanese Science & Technology Policy

2.1 The Science and Technology Basic Law

The 1990's were often called 'the lost decade', referring to the prolonged economic recession Japan faced. With this background, the Science and Technology Basic Law was promulgated in 1995 to equip the government with a legal basis to pursue the objective of the 'Nation Based on the Creation of Science and Technology', which required the costly and long-term engagement of the government.

The Law can be summarised as follows: The State becomes 'responsible for formulating and implementing comprehensive policies with regard to the promotion of S&T'. Thus the former is expected to take the necessary measures, especially a budgetary one. The Law emphasises concern about the co-operation between national research laboratories, universities and the private sector, the right balance between basic research, applied research and development, and the training of researchers. Particular attention is paid to preserving the autonomy of researchers and specifying research activities within the university sector. The Law envisages the establishment of a basic plan to promote S&T,

which will contain operational policies. The Council for Science and Technology has to be consulted prior to formulation of the basic plan.

2.2 The Science and Technology Basic Plans

The first Basic Plan, covering 1996-2000, with the total budget of 17 trillion yen (actual expenditure 17.6 trillion yen), mainly focused on the improvement of R&D conditions. The First Basic Plan [15] proposed:

- To double the domestic expenditure on R&D financed by the government as a percentage of GDP by 2000;
- To increase research funds allocated on a competitive base;
- To attain the objective of 10,000 financially supported post-doc positions by 2000;
- To implement measures to facilitate inter-sector (industry, universities and national research laboratories), inter-regional and international exchanges, for example by increasing the number of fixed-term positions and co-operative research projects, and by facilitating technology transfers;
- To implement assessment systems regarding publicly supported R&D themes, management of research institutions, and activities of researchers in the public sector;
- To improve the R&D infrastructure regarding physical assets, information technology and intellectual assets (for example databases and standardisation).

Along the lines of the Basic Plan, a certain number of laws and measures were implemented, reinforcing the tie between industry and universities. Indeed, universities were expected to become major players, as knowledge-creating institutions and through their training function, leaving behind their ivory tower image.

The Second Basic Plan, covering 2001-2005, has been prepared based on an assessment of the First Basic Plan, submitted by the newly founded Council for Science and Technology Policy (CSTP) to the government, and adopted at a Cabinet meeting in March 2001 with the total budget of 25 trillions yen.

The Second Basic Plan[16] launches its concept of 'science and technology within the society, serving the society, and receiving feedback from the society'. Accordingly, it defines three general objectives that Japan has to pursue, which are:

- To become a centre of knowledge creation and exploitation;
- To build up a secure society;
- To ensure international competitiveness and sustainable development,

[15] See http://www8.cao.go.jp/cstp/english/basic/1st-BasicPlan_96-00.pdf

[16] See http://www8.cao.go.jp/cstp/english/basic/2nd-BasicPlan_01-05.pdf

- To specify how science and technology may contribute to reach these objectives.

The major change with regards to the First Basic Plan is that the government clearly affirms its intention to build a technological innovation system that will serve the society as a whole, and its preference for a 'strategic' and 'targeted' approach. Besides the traditional support for basic research, research funds will be allocated giving priority to the fields of life sciences, information technology, environment, nanotechnology and materials, energy, manufacturing technology, social infrastructure, and new frontiers likely to bring solutions to the major problems that will face society in the future.

The current Third Basic Plan, covering 2006-2010, for the first time, refers explicitly to 'Innovation' as a target for science and technology policy and more generally as a driving force of economic growth. With the total budget of 25 trillion yen, the Third Basic Plan[17] express its objective to 'accelerate innovation' by building-up world-class 'Centres of excellence', stimulating interdisciplinary fields, and enhancing the quality of human resources. Also, it proposes to realise the system reforms with the aims to enhance the mobility of people, to attract foreign researchers, and to make research environments more competitive.

2.3 Innovation 25

Against this background, the Long-term Strategic Guideline 'Innovation 25'[18] has been formulated in 2007, aiming to make Japan one of the most innovative counties in the world by 2025, through the design and implementation of a wide range of policies. This initiative applies to Japan's social system as well as to scientific and technological research and development. The guideline sets specific goals for realising highly challenging technologies, but also addresses policy tasks the government must tackle in realising the diffusion of such technologies, which include education reforms, regulation system reviews and financial support. Universities are at the core of the strategic guideline, related recommendations being:

- Reforming universities to become the centre of education and research;
- Opening educational and research institutions to overseas and participating in research activities at an international level;
- Urging universities to accept students without distinguishing between science and humanities majors and providing them with a broader education.

In view of global-scale science and technology competition, gaining emphasis on innovative people, and building-up 'innovation ecosystem', reform of the university system has been urged.

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[17] See http://www8.cao.go.jp/cstp/english/basic/3rd-Basic-Plan-rev.pdf

[18] See http://www.kantei.go.jp/foreign/innovation/innovation_final.pdf

What should be retained from this overview? First, the Japanese government continues to concentrate its effort in science and technology, in particular in innovation. Second, it recognises that a condition *sine qua non* to accelerate innovation is 'opening the country', thus international science and technology co-operation becomes a strategic issue for Japan.

3. International Science and Technology Co-operation

3.1 Facts

It is worth noting that Japan has already a long list of bilateral science and technology co-operation agreements concluded by the past (41 countries[19]), and that, some others, including European Union and Switzerland, are under negotiation. Also, Japan is contributing to multilateral science and technology co-operation through its participation to:

- OECD/Committee for S&T Policy;
- APEC/Industrial Science & Technology;
- G8 Carnegie Group conference;
- Heads of International Research Organisation Meeting (HIRO).

Based on these bilateral agreements and multilateral frameworks, multitude of collaborative research projects, conferences, and exchange of researchers and students have been initiated. That is to say, Japan is not a newcomer on international scene. However, even it demonstrates an upward trend, the mobility of researchers remains at a relatively low level compared to the US or European countries, also there is a strong imbalance between inflow and outflow (34,939 foreign researchers visiting Japan against 137,251 Japanese researchers abroad in 2005 – see Table 1). Thus The Japanese government intends to reinforce international co-operation to gain Japan's attractiveness vis-à-vis international science and technology community and also to instil openness to the inward-looking Japanese science and technology community.

3.2 Science and Technology Diplomacy

The CSTP launched a new tool to promote international science and technology co-operation called 'Science and Technology Diplomacy[20]' in April 2007.

Recognising that environment problems are worldwide issues, which have a potential to deepen north-sough divide, the CSTP proposes to take initiative by using Japan's science and technology capabilities to realise a sustainable society. Linking research co-operation and technology co-operation to foreign policy is

[19] Countries are: the United States, France, Germany, England, Italy, Holland, Sweden, Finland, Canada, Australia, Korea, China, India, Israel, Russia, Former URSS countries (Kazakhstan, Kyrgyzstan, Uzbekistan, Armenia, Georgia, Ukraine, Belarus, Moldova, Turkmenistan, Tajikistan), Poland and Former Yugoslavia (Bosnia and Herzegovina, Serbia, Serbia and Montenegro, Slovenia, Croatia, Macedonia), Brazil, Indonesia and Eastern European countries (Romania, Bulgaria, Czechoslovakia, Slovakia, Hungary), the Republic of South Africa, Norway and Vietnam.

[20] See http://www8.cao.go.jp/cstp/english/policy/stdiplomacy.pdf

itself an institutional innovation, given the division of work between the Ministry of Foreign Affairs and all science and technology related Ministries. The CSTP proposes to:

- Strengthen science and technology co-operation with developing countries, particularly in Africa, by using official development assistance (ODA), with a particular focus on environmental, water, & infectious disease problems;

Table 1 Exchange of Researchers: Top 10 Countries (2005)

Japanese researchers visiting abroad		Foreign researchers visiting Japan	
USA	35,060	China	7,045
China	14,805	USA	5,419
Korea	11,570	Korea	4,071
Germany	6,662	Germany	1,554
France	6,311	GB	1,463
GB	5,976	France	1,331
Thailand	4,324	Russia	1,103
Italy	4,033	Thailand	1,074
Canada	3,810	India	945
Australia	3,541	Taiwan	944

Source: Ministry of Education (2008), http://www.mext.go.jp/b_menu/houdou/20/01/08020410/009.htm (in Japanese)

- Disseminate Japan's environment technology to the world, particularly in developing countries (for example by using satellite imagery, data from the Earth Simulator, by providing locally technological support in the fields of environment, energy and water);
- Foster world environmental leaders (by implementing training programmes);
- Strengthen co-operation in advanced science and technology fields (by opening Japanese universities and public research institutions);
- Reinforce networks for science and technology co-operation, overseas centres being expected to play a role of hub.

In the FY 2008 budget proposal, 8.6 billion yen has been budgeted for 'Science & Technology Diplomacy'. The G8 Summit, which will be held in Japan in July 2008, is perceived as an opportunity to launch this 'Science and Technology Diplomacy' on the international scene.

4. Co-operation with the European Union and its Member States

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) has a committee[21] charged to recommend Minister on issues related to international affairs. The co-operation with the European Union and its member states is a part of its competency and a position paper called 'Strategic approach to promote international science and technology co-operation with Europe'[22] is under preparation.

Given that the EU is implementing the Lisbon Strategy and realising the 'European Research Area' by promoting networks and mobility of researchers, the committee recommends reinforcing the relationship with the EU beyond bilateral co-operation with member states (20 agreements signed) and individual researcher's level collaborations, the reason being:

- The EU has a long experience and practice of diversity, so that through science and technology co-operation, Japan will learn how to promote the respect of diversity within its scientific community;
- Given that other Asian countries, such as China, Korea and India, are gaining their attractiveness among international science community, Japan is urged to reinforce its presence on the international scene, in particular through the European Union;
- Japan has already participated to large-scale advanced research projects implemented within Europe, such as the ITER, IODP, GEOSS and CERN, and expects to enlarge the scope through co-operation with the EU.

To take steps in this direction, Japan should resolve the problems such as:

- To set-up an institutional framework to go beyond the exchange of information;
- To ensure the financial resources for matching funds;
- To ensure within universities and other research institutions that administrative tasks related to international co-operation will be conducted professionally;
- To set-up an institutional framework to promote international mobility of researchers, where the 'Marie-Curie Action' could be a model.

Also the committee proposes six objectives to be pursue through science and technology co-operation with the EU:

- To solve problems we face at a global level such as global warming, energy, environment, global food problem;
- To keep diversity in research activities;
- To develop multi-tier network, including governments, funding agencies, and research institutions;
- To increase mobility of young researchers;

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[21] The Science and Technology Policy Bureau is charged to act as secretariat.

[22] See http://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu9-1/shiryo/04/07121905/001.htm (in Japanese).

- To strengthen the presence of Japan on international science community;
- To co-operate in elaborating international standards and regulations.

5. Conclusion

Knowledge production is becoming more and more specialised and strongly competitive, but at the same time it tends to gather people coming from different horizon and background in a mode-2 manner. Another fact is that knowledge circulates without any frontier due to its public good characteristics and thanks to the development of ICT, it circulates almost instantaneous all around the world. How to take advantage of this context and to gain one’s innovation capacity?

The choice of Japan is to move toward a new framework based on competition, collaboration and co-operation, identifying the European Union as a potential partner with whom a mutually beneficial relationship could be constructed.

Mechanisms to Foster Mutual Benefits and Priorities in International S&T Co-operation as seen from the Perspective of Egypt

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1. Introduction

An established tradition of scientific research since early 20th Century was interrupted towards the mid-century by the succession of armed conflicts and their aftermath of financial difficulties. This stretched on for a number of decades. Severely reduced budgets and the low ranking of research activities on the development agenda represented a significant setback for the advancement of scientific research in the country. Two vital sectors, agriculture and irrigation/water resource management were less affected. Apart from being vital to the very survival of the country, they reposed on an older tradition of state financed operational problem solving type of research that had been ongoing for well over a century. During that same period, industrial production activities were modest and rarely engaged in the manufacturing of goods that are the product of local inventions or innovations. It was esteemed preferable to limit the risks and to invest in production lines for a selected few already proven technologies imported from abroad and adapted for local use.

Technological advances witnessed in all disciplines in recent years, and the rapidly developing information and communication technology sector, are behind the recent growing demand for re-instating science and technology research in its rightful place on the development agenda. Realising the full importance of research and development and innovation to the advancement of an Egyptian economy based on knowledge, and desirous of sustaining the early manifestations of its advancing economic growth, the government is engaged in a major effort for rehabilitation of the research system in Egypt. The reform process involves some 380 already existing research organisations that have been listed by the Academy for Scientific Research and Technology (ASRT). The stated aim for reforming the research system in the country is to advance science and technology research in a number of strategic priority domains with the objective of creating a knowledge-based community and an infrastructure that can lead to the development of a national economy that is also knowledge based. National priorities were identified in four domains, namely:

- Research initiatives in domains that support the development of an economy based on knowledge, such as bio-technology; information and communication technologies; nanosciences, materials and new production technologies; new and renewable energy sources; management of water resources, space and atomic energy research (for peaceful purposes);

- Domains involved in further developing and modernising the productive and service sectors;
- Initiatives that serve medical and pharmaceutical research, in particular in the area of cancer, liver and kidney disease;
- Basic sciences research in mathematics, physics and chemistry.

2. Priority Setting for Research (the Case of Egypt)

The two research systems with well established and structured procedures for identification of national research needs and for formulation of the appropriate response, are the research institutes (over 70 spread all over the country) of the Agricultural Research Centre (ARC) of the Ministry of Agriculture and Land Reclamation, and the Water Research Institute with its affiliated organisations of the Ministry of Irrigation and Water Resource Management. The ARC invites the participation of all stakeholders - including suppliers of agricultural materials and equipment - in a structured bottom-up process that identifies research needs and the strategies to address them within the previously identified national priorities. Formulation of research plans, mobilisation of partners and allocation of resources follow. Research is mostly oriented towards problem solving and often produces innovative work in a number of fields that relate to the identified local priorities. In a situation of bilateral, regional or international collaboration in S&T research, the ARC enters into negotiation with the external partners and agrees on priorities that are of shared interest and that fall within the domain of the already identified list of national priorities. Preference goes to forms of co-operation that involve transfer of technology and know how, and maybe also study visits. The irrigation and water resource management sector, because of its vital importance to the very existence of the country has - by necessity - maintained a lead role in water related research and has all its targets and priorities worked out. This is corroborated by the fact that out of the 71 projects in which Egypt participated in the 6th Framework Programme, 31 were in the area of water. The above two sectoral research organisations are considered a good example of a system with an established mechanism for priority setting and research target formulation that is able to conclude mutually beneficial international co-operation agreements.

Priority setting mechanisms adopted by various other research organisations do not always follow a comparable structured mechanism for formulation of a research plan with identified targets in a given priority domain. This means that even if a set of priorities is identified for an institution, these priorities do not necessarily reflect priority research domains that relate to national needs. The NRC (National Research Centre), the largest multidisciplinary research institute that hosts about 70% of all the researchers in the country, has identified 4 priority research domains. Three of which are selected on the basis of being internationally recognised as a research priority. The fourth domain is referred to as 'mixed', allowing researchers the freedom to select their own research topic. With the diminution in state funding and the growing dependence on sources of external funding for research activities in Egypt, the issue of how far the dependence on external funds can distance research activities away from national priorities, drawing them more towards those of the donor agency, remains to be assessed.

When drawing up regional and/or bilateral S&T co-operation agreements for institutions not operating through a structured mechanism for identifying research needs and in the absence of strategic intelligence on research priorities, the deciding factor in the negotiations is often how much benefit will be gained from the agreement, in terms of funds and hardware, knowledge and technology transfer and other benefits. National priorities may not always act as a determining factor in such negotiations. Careful preparation for identification of research targets will serve to avoid overlap, duplication of effort and wastage of resources in research programmes funded by the EU, or other development agencies and/or donors.

Egypt's geopolitical position in Africa (and the Middle East) results in its involvement in a number of politically motivated alliances of a regional or sub-regional nature with its African or its Arab neighbours. The affiliation of the country to bodies such as the African Union or the Arab League leads to a set of partnerships in S&T research in fulfilment of an overall co-operation agreement and based on a set of regional type priorities previously identified and agreed by all member states. The length of the required preparatory work and of the interval preceding allocation of resources, limits the collaboration to areas of research that usually do not relate to time bound priorities. No evaluation was ever undertaken to assess the scientific value or benefits gained from engaging in such collaborative programmes. The case of NEPAD (New partnership for Africa's Development) offers a different example of international co-operation. In this case, the European Commission (EC) provides international co-operation support to increase the capacity to deliver agricultural innovation for Africa. This is done through the European backed PAEPARD programme (Platform for African European Partnership for Agricultural Research and Development) which aims at mobilising African and European resources for achieving the objectives of the African Union in the above-mentioned domain.

A more concentrated modality for a European support to S&T is through the bilateral activities that continue over a whole year as in the recent example of 2007, which had been designated as the 'Year for Germany-Egypt Collaboration in S&T' (Japan was designated for 2008). This mobilises German scientists specialised in a number of fields that had been jointly identified as priority areas for German co-operation, to visit the country and share new scientific advances and innovative technologies, entering into dialogue with their Egyptian counterparts and multiplying opportunities for direct co-operation, collaboration and networking. For European countries, agreements for collaboration that follow in the wake of such bilateral activities are reported as such on the EU Delegation website and are usually regarded as complementary to various activities of the 7th Framework Programme or other current EC support to Egypt in S&T research.

Collaboration in S&T research is more than often the result of a network of relations and contacts with individual researchers. Many of the scientists and research teams that keep up an advanced level of scientific performance are those who have received post graduate training abroad and have kept up a relations with their respective mother institutions and are often members of an active network of peers. Publication of significant research achievements and/or presenting innovative breakthroughs in the course of international gatherings serves to draw counterparts and potential partners. Encouraging the participation of Egyptian scientists in regional or international scientific events as part of a partner targeting process could become a government backed policy whenever feasible. While European support and co-ordination projects call for the mapping of non-European research organisations and research teams, the European partners who are members in the same project Consortium do not automatically undertake a similar exercise. Identification of partner researchers or organisations from Europe is not considered to be an easy task for scientists who are not familiar with the European research environment. A laudable initiative has been made this year, by the recently launched support and co-ordination project BIONET, to map European research organisations and teams and create a database for those engaged in research under FP7 Theme II, Food Agriculture, Fisheries and Biotechnology.

3. Priority Interests for Egypt in International Research Co-operation

Under the best of conditions, priority setting in international research co-operation is the outcome of a negotiation process with the international partners that is based on a structured process for identification of national priorities that fall within one or more of the four priority domains identified in the research system reform (see above). The main interests of Egypt cover: (a) knowledge and technology transfer; and (b) to receive and learn to use and apply advanced technology.

4. Challenges/Conclusions

The main challenge for Egypt at this point in time is to compensate for the lost years (see introduction) and to accelerate its latecomer strategies for catching up on S&T and innovation capacity building without waiting for the full research system reform to become operational. To this end, maximising to the utmost on the returns of the various capacity building mechanisms and supportive activities offered within the FP 7 Work Programmes becomes a duty and a necessity.

Other challenges to be taken up include the following indicative and not exhaustive list that covers a number of managerial issues as well as research related issues:

- To review and improve the current national system that is in place for the management of the interface between the EC and Egypt, keeping in mind that all EC agreements, policies, declarations, Ministerial decisions and other various instruments; in addition to the mechanisms that are in place to service them are conceived in a manner that guarantees continuity and synergy among the various related elements. Dealing with them as separate entities relegates the country to a reactive mode that keeps it on the fringe of EC business and not necessarily part of it. The links between the different concerned sectors (notably Foreign Affairs and the Ministry of Higher Education and Scientific Research and Technology) and the persons servicing this interface on the Egyptian side may need to be reviewed and strengthened. Supportive management information systems are an important supportive tool that needs to also cover the generation and communication of 'feedback' information that is instrumental in completing and closing the managerial information circle.

- To be able to recognise and build on the 'Synergy' that is produced as progress is made in implementing the various EC activities and instruments. Missed opportunities for 'synergy' building can undermine the performance of Egypt in a given situation.
- To be aware of the many references to S&T in declarations, articles, clauses and in other various directives for strengthening S&T components that occur in various EC instruments as well as in the EC supported S&T (or RDI) capacity building projects and activities as this will enable them to be implemented under the best of conditions that can guarantee return benefits.
- To make a point of reaching and communicating with ALL members of the Egyptian research community wherever the may be stationed and to make sure that they have access to knowledge and information on FP7 and the research themes of interest to each one of them; not forgetting to include private universities, civil society and SMEs.
- To give visibility to the EU partnerships and achievements in Egypt so that all the scientific community, development workers, civil society organisations and the people themselves should become aware of and knowledgeable about the EU-Egypt partnership and the Euro-Med collaboration that is being implemented.
- To identify strategies that foster and encourage a culture of interdisciplinary and trans-sectoral teamwork that overcomes the protected sectoral turf of individual research partners and thus enables Egyptian researchers to build multidisciplinary teams that can join EU partner teams in addressing cross-thematic research topics.

5. Recommendations/Observations for European Priority Setting

- It may be useful to refer to the partner country's UN Development Assistance Framework (UNDAF) in which the country's development priorities are analysed. Representatives of locally stationed international organisations - including the EU Delegate - contribute to identifying these priorities.
- More effort is needed for relating S&T research priorities to the Millennium Development Goals (MDGs). Though repeatedly declared a priority within FP 7 strategic approaches, more visibility may need to be given to MDG related research topics.
- Mechanisms for priority setting for international co-operation in domains involving cross thematic issues such as in health and the environment may need to also reflect the trans-sectoral nature of co-ordination imperatives that are required to accompany their implementation.
- Egypt is now in a position to benefit from the priority setting learning experience that it will gain from its participation as a member of the recently awarded ERA-NET project on agricultural research policy co-ordination, the priority setting option being is an important element in the ERA-NET process.

- Nationally organised thematic brokerage meetings have been observed to provide a forum that encourages researchers to propose and defend identified research priority topics or domains for international co-operation. All proposals are further 'processed' in Brussels and the outcome will probably depend on their scientific value and relative strategic importance.
- It may be considered timely to explore how - and when - MEDA countries can be associated with the setting up of a European Science and Technology Foresight Knowledge Sharing Platform for Interpretation of Strategic Intelligence and Priority Setting for International Co-operation.
- European Technical Platforms (ETP) provide a framework for stakeholders, led by industry, to define research and development priorities, timeframes and action plans on strategically important issues where achieving future growth, competitiveness and sustainability is dependent on major research and technological advances in the medium and the long term. In view of the strong and true statement made under the paragraph reporting on EU- Egypt Co-operation on Science, Technology and Innovation [EC Bilateral Co-operation (MEDA) programme to support Research and Innovation in Egypt] stating that: *"…one of the most hampering factors for the economy to innovate is the few direct links between research and industry". R*ecognising the role played by European Technical Platforms it is proposed to introduced the Food-for-Life ETP (proposal under study) given their past experience in setting up similar 'international' platforms in MEDA partner countries. The agrifood industry in Egypt is well developed and well positioned to interact with such a platform. It is hoped that once the Technical Platform is accepted and becomes operational, domains for priority international co-operation in S&T can be identified by the Egyptian agrifood-processing sector.

International S&T Co-operation Priorities and Mechanisms to Foster Mutual Benefits, as seen from the Perspective of New Zealand

Kenneth Husted, University of Auckland, New Zealand

1. Introduction

Until recently New Zealand did not put a strong emphasis on international science collaboration at a national research policy level. However, it would be wrong to conclude that New Zealand based researchers have not been actively engaged in international research co-operation. In 1999, 36% of all research publications with contributions from New Zealand based researchers were co-authored with researchers from outside New Zealand. On a global scale, this is one of the highest levels of international co-authorships and indicates a very active bottom-up research co-operation between New Zeeland based researchers and the international research community.

Despite New Zealand's rich engagement in bottom-up research co-operation, the New Zealand government has recently recognised that a lack of appropriate bilateral relationships and a lack of funding available for researchers to engage in international scientific collaboration, particularly where co-funding is required, might have had a constraining effect on the participation of New Zealand based research in international collaboration and especially in international research collaboration of strategic importance to New Zealand.

2. Context

New Zealand has a population of approximately 4 million. The country has traditionally had a strong dependence on the primary sector, which after WWII has contributed significantly to national wealth creation. Recently, productivity levels in New Zealand are lacking behind OECD average. The government has introduced a new knowledge and innovation focused growth strategy to close the gap.

2.1 Geographical Distance

For most countries geographical distance is less and less of an issue for international co-operation. This is however not the case for New Zealand. A travelling time of approximately 30 hours in each direction between New Zealand and Europe has significant impact on travelling patterns. Considering an increasing awareness of the environmental impact of air transport, one can expect travellers to be increasingly aware of the 'knowledge-miles' involved in international research co-operation.

The most noticeable impact of distance on research co-operation is the tendency to longer stays either by visitors to New Zealand or when New Zealand located researchers travel abroad. This obviously contributes to establish stronger ties with already existing research co-operations. The main problem caused by substantial geographical distance is a less extensive network of weak ties due to the reduced ability to participate fully in more regular co-ordination and network activities. This problem is further reinforced by a 9 - 12 hours time difference between New Zealand and Europe. As a result of this time difference, there is no overlap in official working hours between New Zealand and Europe making direct communication dependent on special arrangements and agreements.

New Zealand's participation and active involvement in international research co-operation would obviously benefit from augmentation of a shared e-science platform, including standards and routines for managing and governing virtual (or at least partly virtual) research co-operation.

2.2 Low Level of Industrial BERD

Traditionally, the level of business investment in R&D in New Zealand has been rather low. In 2004, businesses in the country invested 0.49% of GNP in industrial R&D. However, this relatively low level of investment should be seen in the light of the fact that New Zealand does not have any activity of significance within industries that traditionally allocate substantial funds to R&D, e.g. pharmaceutical industry and chemical industry. In 2007 the government has introduced a tax incentive for industry investment in R&D.

The problems caused by the lack of industrial R&D are twofold. First, it is difficult for New Zealand universities to find a local industrial partner who is strongly interested in taking part in international research co-operation, not to mention finding a local industry partner who is pushing its own agenda and interests in being a partner in international research consortia. Second, New Zealand is disadvantaged by a relatively low level of corporate absorptive capacity and will most likely benefit less in terms of value creation from international research co-operation compared to its international research partners.

The implications of the low level of industrial R&D on priority settings for international research co-operation could be an increased focus on research areas and topics that are well suited for involving SMEs and especially SMEs that are not very experienced in research or research co-operation.

2.3 Productive Research Environment

Measured on resources invested, New Zealand based researchers create a relatively high output measured in publications. This high research productivity is also seen in other smaller societies like Denmark and Norway and is partly a consequence of the fact that smaller countries rarely take responsibilities for establishing and utilising large instruments and research facilities. Another factor is that historically, the research funding system in New Zealand has had a healthy balance between bottom-up and top-down priority setting which has allowed New Zealand based researchers to react to and exploit productive positions and opportunities in their research landscapes. More recent national priority setting has become more top-down influenced and integrated with other policy areas, most importantly with the innovation area and with policies for creating economic growth. However, instruments for national priority setting still maintain a significant bottom-up component, e.g. roadmaps that enable autonomous co-ordination and consultation used for developing programmatic calls.

2.4 Trends

During the last four years New Zealand has engaged in a number of change processes, either with a direct or indirect positive impact on fostering increased participation of New Zealand based researchers in international science co-operation:

- International research co-operation is changing from being primarily a bottom-up driven to a strategic level issue. New Zealand has traditionally had a strong tradition for its researchers to co-author research; publications with researchers abroad. However, this very fertile bottom-up driven co-operation has until recently not been strongly supported at a strategic science policy level. These shortcomings have been addressed in a strategy for international collaboration, which is described in 'International Linkages Strategy 2005-2007';[23]
- Funding structures and governance are applied to develop the right instruments. The funding environment is changing from a situation with very few dedicated resources for international co-operation to increasingly making recourses available for seed and mobility programmes;
- Fine-tuning of the research funding system. It has been recognised that the limited resources available for research combined with the preferred mode of allocating research funds through an open, contestable, policy neutral approach has constrained the ability to reach fast to and exploit opportunities for participating in internal research collaboration. The government improved this situation by establishing the International Investment Opportunity Fund in 2004. The ambition is to offer co-ordinated funding with FP7. This would allow New Zealand based researchers to engage in larger and more formalised and strategically important research co-operation in selected areas;
- Specialisation and excellence - Moving away from 'usual suspects' to national strengths (high tech or not);
- Increase the promotion of New Zealand's R&D capacity by utilising internationalisation efforts by all government agencies. The relatively small size of the public sector in New Zealand facilitates flexibility and cross-departmental collaboration that should be utilised for strengthening the reputation of New Zealand's R&D capacity overseas with an increase in international collaboration as a consequence.

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[23] See http://www.morst.govt.nz/publications/a-z/i/international-linkages-strategy-2005-2007/

3. Milestones

Collaboration and interaction with the European Union is important to New Zealand. The EU is the major source of imports, which were worth NZ$6.7 billion in 2004, while EU also took $5.1 billion of New Zealand's exports. The EU is also New Zealand's 2nd largest source of visitors (450,000 in 2003). New Zealand's research co-operation with EU is generally recognised as important and valuable to the country. The institutional foundation for the relations has developed radically during the last 3 years. It has developed from a level of laissez fair and primarily embedded in strong bilateral links with UK, France and Germany to structured relationship based on formal co-ordination and mutual resource commitment. The following milestones signify this development:

- 1991: Science and Technology agreement. The agreement provides for co-operation in the 'fields of science and technology of mutual interest' including agriculture, biomass, biotechnology, environment, forestry, renewable energies and telecoms/information technologies;
- 2004: Science Counsellor. The Ministry of Research, Science and Technology appointed New Zealand's first science counsellor, based in the Brussels Embassy;
- 2006: Co-Funding of platform to facilitate co-operation (FRENZ)
- 2006: Inaugural EC-NZ Joint Science and Technology co-ordination meeting (biannual). The committee will co-ordinate collaborative activities. At the first meeting it was agreed to focus future co-operation on the following areas: health, food, agriculture and biotechnology, ICT and environment;
- 2008 – Launching IRSES (International Research Staff Exchange Scheme);
- 2009 - Co-ordinated call;
- 2010 - ???

This development reflects a stronger top-down commitment to stimulate further research co-operation between EU and New Zealand. The focus has so far predominantly been on introducing mechanisms that increase awareness about partnering opportunities and initial contacts. Looking at the future activities in the pipeline, it seams that the future focus will increasingly be on developing funding mechanisms which enhance actual research co-operation e.g. through exchange programmes and co-ordinated calls for research funding.

4. Challenges

Develop a funding structure that supports simultaneous resource commitment. A major challenge in international research co-operation is to time the resource commitment of the participating partners. From a transactional perspective, the simplest approach would be for one or both of the partners to introduce the principle of 'automaticy' in funding, meaning that national funding will be made available if the partners in the collaborating country have managed to secure funding for their part of the project. However, such approach, despite being easy and cheap to manage, suffers from the risk of strategic disconnect with strategic objectives of the society that applies the 'automaticy' principle. A more feasible approach that would maintain national influence on which areas are funded would be to fund co-operative research through shared calls with shared evaluation processes.

Develop priorities for form rather than content:

- Multi disciplinarity
- Virtual research organisation
- Flexible governance structures
- Cross cultural collaboration

Improve industrial absorptive capacity and participation in international research co-operation.

Balance measures to enhance co-operation with major regions of the world. Besides co-operation with EU based researchers, New Zealand has traditional strong collaborative ties with both the US and Japan. Besides maintaining and further enhancing linkages with the major regions, New Zealand is also due to its Asian-pacific location looking at establishing tight links to the fast developing Chinese research community. The Ministry for Research, Science and Technology (MoRST) has recently developed a country assessment system that enables categorisation of potential partner countries in three categories: focus, strategic priority and national priority.

Appendix 1

Agenda and Participants

WORKSHOP ON RESEARCH PRIORITY SETTING FOR INTERNATIONAL S&T CO-OPERATION

Brussels 25 & 26 September 2007

AGENDA and PARTICIPANTS
DAY 1 - 25 September 2007

Introduction and Welcome		
11:00	Background to the conference	Mary Minch, Director for International S&T Co-operation, DG Research
11:10	Workshop overview and objectives	Callum Searle, International S&T Co-operation, DG Research
11:20	Motivation, benefits and barriers to international research collaboration	Erik Arnold, Group Managing Director, Technopolis, UK

SESSION 1 – Experience of Priority Setting in Other Programmes		
S&T Priority setting in the national and international context		
11:45	Aligning International Research Collaboration with EU Policy Needs	Giancarlo Caratti, Directorate for Programmes and Stakeholder Relations, European Commission, Joint Research Centre
12:15	Priority setting in the national context - analysis and developing conclusions from the CREST internationalisation working group	Klaus Schuch, Centre for Social Innovation, Austria
14:00	International S&T co-operation priority setting in ERA-NETs	Luis Delgado, Ministry of Education and Science, Spain
14:30	Priority setting in technology platforms: International S&T co-operation in the Sustainable Chemistry Technology Platform	Sophie Wilmet, Innovation Counsellor, CEFIC, Belgium
15:00	**Discussion Session 1**: Mutual learning - lessons for international co-operation	Animator: Ken Guy, Director, Wise Guys Ltd, UK Discussants: Session 1 speakers
16:15	Break	

SESSION 2 – Priority Setting in the EU		
Identifying topics and priorities		
16:45	The role of foresight activities in identifying topics and the development of priorities for international S&T co-operation	Totti Konnola, DG Joint Research Centre, Institute for Prospective Technological Studies, Spain

DAY 2 - 26 September 2007

SESSION 2 – Priority Setting in the EU (continued)		
Balancing criteria and establishing priorities		
9:00	Options for balancing criteria and establishing priorities for international S&T co-operation	Ian Halliday, President, European Science Foundation; EURAB Member; Chief Executive of the Scottish Universities Physics Alliance, UK
9:30	Establishing priorities for international S&T co-operation, balancing political and academic perspectives	Eduardo de Oliveira Fernandes, Professor of Mechanical Engineering, University of Porto
10:00	Data requirements for the determination of priorities, their weighting and modification in international co-operation with particular reference to the ERA-WATCH and RIPWATCH activities and their potential contribution	Liana Marina RANGA, Business School, Newcastle University, UK
Modifying priorities		
11:00	Modifying priorities in international S&T co-operation focusing on globalisation and the changing needs and behaviour of industry	Göran Marklund, Director and Head of Strategy Development Division, VINNOVA, Sweden
11:30	The modification of existing priorities in face of a changing international environment: Contribution from OECD studies on systems for the determination of S&T co-operation priorities	Bernhard Dachs, Austrian Research Centres, Systems Research Department of Technology Policy, Austria
12:15	**Discussion Session 2**: Priority setting levels and actors.	Animator: Ken Guy, Wise Guys, UK Discussants: Session 2 speakers
13:15	Lunch	

SESSION 3 – Non-EU Partner Perspectives		
14:15	**Panel Discussion Session 3**: Assessing the attitudes and needs of potential third country partners and reaching common goals for international research co-operation.	Animator: Laurent Bochereau, Science Counsellor and Head of S&T Section, EU Delegation, Washington, USA. Discussants: Yuko Harayama, Council for Science and Technology Policy in Japan and Professor, Management Department of Science and Technology, Graduate School of Engineering, Tohoku University, Japan Habiba Hassan-Wassef, Centre for Rural Development Researches and Studies (CRDRS), Cairo University, Egypt Kenneth Husted, Professor of Innovation and Research Management, The University of Auckland Business School, Auckland, New Zealand. Jack Lightbody, Deputy Assistant Director, Mathematical and Physical Sciences, NSF, Washington D.C., USA

SESSION 4 – Conclusions		
16:00	Drawing lessons from the workshop	Rafael Rodriguez, Consejo Superior de Investigaciones Cientificas (CSIC), Spain Ken Guy, Wise Guys, UK
17:00	Close of Workshop	

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