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CREST Working Group

Internationalisation of R&D – Facing the Challenge of Globalisation: Approaches to a Proactive International Policy in S&T

ANALYTICAL REPORT

Policy Approaches towards S&T Cooperation with Third Countries

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This report summarises the results of analytical and empirical work, mutual learning exercises and thematic discussion of the CREST Working Group. It does not necessarily reflect the official views of the Member States, Associated States and the European Commission.

Preface

The work on this report was conducted by a Working Group set up by CREST as a part of the process of Open Method of Coordination (OMC).

21 Member States and Associated States joined activities of the CREST Working Group: Austria, Belgium, Czech Republic, Denmark, Germany, Greece, Finland, France, Ireland, Island, The Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

Seven meetings of the CREST Working Group were held.

The chair of the CREST Working Group was Jörn Sonnenburg (International Bureau of the German Federal Ministry of Education and Research at the German AeroSpace Centre).

The rapporteurs were Arie van der Zwan (Ministry of Economic Affairs, The Netherlands) and Peter Teirlinck (Belgian Science Policy Office).

EU Directorate General for Research gave valuable contributions to the work through Peder Christensen (C.3) and Heiko Prange-Gstöhl (D.2). Jan Nill and Gaston Heimeriks from the Institute for Prospective Technological Studies (IPTS), Joint Research Centre of the European Commission provided analytical support to the work of the group as part of the ERAWATCH project. Klaus Schuch (Centre for Social Innovation, Austria) and Sylvia Schwaag Serger (Swedish Institute for Growth Policy Studies, ITPS) provided analytical support as external experts.

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Executive Summary

Background

Globalisation is an overarching 'mega-trend', which will increasingly shape the world during the next decades. It will sustain world economic growth, raise world living standards, and substantially deepen global interdependence. At the same time, it will generate enormous economic, demographic, environmental, energetic, cultural, security and consequently political convulsions. Although the overall benefits are expected to be positive, the net benefits of globalisation will not necessarily be global.

Europe, its Member States and the states associated to the European RTD Framework Programme are challenged by globalisation in R&D, which remarkably transcends the former focus on the Triad regions (the US, the EU and Japan). New emerging countries appear on the international science and technology scene, notably the BRICS countries Brazil, Russian Federation, India, China and South Africa. This causes new opportunities for knowledge and technology acceleration including the promise to develop and penetrate new markets, but it also increases the competition for scarce resources, e.g. human capital, leading research infrastructures and foreign direct investments in R&D. A new division of labour develops at world scale and also affects the sphere of science and technology (S&T). The key question is how to benefit most from this phenomenon and at the same time how to reduce risks related to the globalisation process.

Applying the Open Method of Coordination (OMC), it was one of the objectives of this CREST Working Group to take stock on the strategies and activities of the EU Member States (MS) and Associated States (AS) to the European RTD Framework Programme towards the ongoing trends in internationalisation of R&D. In particular, the mandate of the CREST Working Group was

1. to collect and present MS/AS policy approaches to internationalisation of R&D and innovation,
2. to identify good practice, pending questions and problems related to the development and implementation of a proactive internationalisation strategy based on national and Community experiences,
3. to analyse the lessons learnt from coordinated 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 and
4. to develop recommendations related to the international cooperation dimension in S&T of both MS/AS and, if appropriate, also for Community activities.

These tasks have been fulfilled by a work programme which employed a variety of analytical and discursive methods. It was firmly build on the commitment of the members of this Working Group and their readiness to data provision, information exchange, in-depth discussion and mutual learning. The process was structured and evidence-based by empirical investigations (two questionnaire-based inquiries), desk research of policy documents and statistics dealing with the issue of internationalisation of R&D and targeted information inputs from the European Commission and external experts.

The main results, trends, conclusions and statements of this work, which are elaborated in full length in the analytical report are summarised as follows.

Drivers of Internationalisation of R&D

In the field of science and technology, globalisation enhances a tendency for higher reliance on external sources, international collaboration and networking. The greatest benefits will accrue to those countries that can most efficiently access, adopt and exploit new technologies developed at whatever geographical scale, also world-wide. In front of this background, internationalisation in R&D is driven by the aims

- to strengthen research excellence and innovation performance by a better access to foreign sources of knowledge and by increased global cooperation 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),
- to increase 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',
- to prepare the domestic ground for successful European innovations abroad and
- to respond to global problems, international commitments and to foster the role of the EU as a community of values.

Usually three modes of internationalisation in R&D are distinguished[1]:

- international R&D cooperation between partners in more than one country to generate new scientific knowledge and technological know-how, whereby each partner retains its own institutional identity and ownership remains unaltered (e.g. the case of FPs or bilateral intergovernmental S&T programmes)
- international generation of knowledge and innovations carried out by multinational enterprises (MNEs) which create innovations across borders by building up research networks including the establishment of new R&D units in the host country or the acquisition of foreign R&D units (i.e. FDI in R&D)
- international exploitation of innovative know-how and technologies through means of trade, granting of licences and patents, reverse engineering etc.

There are, however, problems interfering against the driving motivations, like insecure intellectual property regimes, unbalanced brain circulation flows, the relocation of FDI in R&D from Europe to other regions (notably Asia) etc. Thus, new concepts need to be developed and tested and efforts (and funds) invested

- to upgrade the impact of international S&T collaboration of S&T institutions in Europe
- to facilitate the international mobility of researchers according to individual career paths through the introduction of more comprehensive brain-circulation concepts
- to enhance spillovers from FDI in R&D to the relevant European research communities, irrespectively if these FDIs are implemented abroad by European companies or domestically implemented by foreign companies

1 Archibugi, D. (2001): European Innovation System. In: Fischer, M.M. and Fröhlich, J. (eds): Knowledge, Complexity and Innovation Systems. Berlin, Heidelberg, New York: Springer, pp. 58-75

- provide better (regulatory) conditions for national S&T institutions and innovative firms on the one hand to better access foreign knowledge and on the other hand to exploit domestic knowledge in Third Countries in a fair manner.

Evidently, to overcome these challenges structural adjustment costs will occur and multi-level dialogues and new governance modes will have to be established which will transcend the traditional S&T frame towards other policy domains (like economic, trade and labour-market policy, development policy, environmental policy, education policy etc.) as well as towards non-political stakeholders (autonomous universities, autonomous research organisations, companies, philanthropic associations, NGOs etc.). This calls also for a revisiting of national innovation policy instruments in light of the differing impact that the internationalisation of S&T has on their relative efficiency and efficacy.

The accelerated internationalisation of R&D is very differently absorbed by the MS/AS, depending – at least partly – on each country's current position on the global R&D map. But also ERA will have to prove itself in a world of globalisation increasingly shaped by open innovation approaches of the business enterprise sector. More systemic policy answers towards the internationalisation of S&T are needed. A first major challenge exists in investigating how the negative effects of globalisation can be addressed without diminishing the benefits of globalisation. In this respect a key question refers to fair global rules (e.g. relating to IPRs, technical and social standards, trade and investment etc.) and the soundness and compatibility of national policy responses. A second challenge involves the S&T responsibility towards global challenges and the specific S&T problems of the developing world. As regards the latter, there is a need for more coordination of policy initiatives between the field of S&T policy and Official Development Assistance (ODA) on one hand and between countries/regions on the other.

Policy Objectives and Strategies of MS/AS towards Internationalisation of R&D

The major objectives of MS/AS regarding internationalisation of R&D towards Third Countries can be subsumed in three bullet points:

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);
2. the objective to gain access to new markets and to increase the own innovation system's competitiveness (in this respect internationalisation of R&D is very often perceived as an important complementary approach to other international economic activities);
3. the readiness to engage in solving global problems which cannot be tackled in an efficient way by an individual country (in this sense a certain commingling with the strategy for sustainable development and the global development goals deriving from development cooperation, 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 R&D 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.

Alternatively, the objectives can be distinguished by such ones, which focus on enhancing the national attractiveness ('inward objectives') and those which focus on connecting to research in Third Countries ('outward objectives'). The 'inward objectives' include

- the objective to attract expatriate and foreign researchers
- the objective to attract inward FDI in R&D
- the objective to promote of national science abroad and
- a set of objectives related to 'clean/prepare the own house' (e.g. in order to offer ideal conditions for research cooperation in a broad range of S&T fields, to continuously develop adequate innovation environments, to turn research into new technologies, innovation and entrepreneurship, to enhance the knowledge society and to provide world top-level education).

The 'outward objectives' relate to

- higher involvement in international cooperation and the enhancement of bilateral and multilateral STI relations (including the establishment of new ones)
- connecting domestic research(ers) into global STI activities (either in general, or focused at frontier or strategic research areas or focused at excellence and greater valorisation, partially complementing and underpinning trade and investment linkages)
- enhancing international mobility of researchers and
- opening of the national research programmes to researchers from third countries.

Ten of the 22 European countries who provided information on the policy objectives towards internationalisation of R&D indicated that they have already a comprehensive national strategy on internationalisation of R&D. An impressive number of eight of the remaining twelve countries stated that they are in process of developing one. In addition, many countries envisage new initiatives, which underpin the dynamic with respect to internationalisation and globalisation of R&D. These planned new initiatives encompass a wide field ranging from far-reaching generic approaches (e.g. to emphasise globalisation as a horizontal priority topic) to more technical, instrumental ones. Frequently indications on envisaged initiatives derive from the wish to implement the existing (very often new) international strategies on S&T and to make them operational (e.g. by developing implementation respectively action plans). Also an assessment of the results and impact of the developed strategies is an issue envisaged by a few MS/AS.

Priority Setting in International S&T Policies

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

1. expected scientific benefits including improving quality and excellence
2. political reasons including solving societal problems and contributing to development goals
3. gaining access to (new) markets, competition and innovation aspects

4. human factors (immigration of knowledge workers, brain drain, brain gain and brain circulation)
5. promotional activities for the national science system
6. geographical, historical, linguistic and cultural ties.

It needs to be underlined, that in case of a partnership with third countries, the common ground is given by mutual interest and a mutual net benefit of the different countries involved. Here, the criteria mentioned above need to be applied by both/all partners and the various perspectives need to be considered. This basic principle is considered one of the assets of any cooperation.

Regarding the 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 cooperation 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 cooperation 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. Most MS/AS 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, national liaison offices in Third Countries and systematic analysis of the participation of domestic research teams with foreign partners in international programmes (especially FPs). Cooperation in information collection with other MS/AS does not happen frequently.

It should be noted that a lot of countries stressed that many forms of official international S&T cooperation are 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 more strategic top down processes.

Across Europe, China and USA are most often mentioned as partner countries. Many MS/AS mentioned additionally Japan and the (other) BRICS 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. It should, however, not be forgotten that overall international cooperation is still dominated by the intra-EU collaboration.

The prioritisation or top-down selection of scientific topics for R&D cooperation with Third Countries is not very much expressed. Half of the interviewed MS/AS did not consider a thematic prioritisation as really relevant, which could be – at least partially – ex-

plained by the bottom-up character of some international schemes. Among the countries which provided more specific answers in terms of thematic priorities, in some cases a certain orientation towards the scientific needs and priorities of the partner countries could be detected. This is especially true as regards developing countries. In general, the thematic range of scientific cooperation is quite broad and only a few obvious thematic specialisations can be identified.

Influential Policies and the Strategy Development Process

Next to S&T policy also other policy areas influence the internationalisation of R&D. These policies include (by rank order) foreign policy (partly in some countries also because of its competence in ODA), followed by economic and labour market policy, development policy and – with some distance – environmental policy. In all but a few MS/AS, the coordination of the development of the national strategy for the internationalisation of S&T lies within the authority of either the relevant science ministry or another national S&T body (e.g. Council for S&T). S&T internationalisation strategies were or are mostly developed cross-governmentally, often by inclusion of important stakeholders with representative functions. Universities and non-university research organisations (or their institutionalised representation bodies) were almost always included. Business organisations were a little less involved and were also perceived as comparatively less important. Very high priority levels were attributed to the inclusion of S&T councils and other R&D advisory bodies as well as research funding agencies.

The implementation of the S&T internationalisation strategies is very often organised by division of labour across different organisational constituencies: ministries, public agencies, science organisations and research councils (in rank order). Business organisations are usually not involved in the implementation of the strategy.

As regards the connection between science and development policies a clear trend towards more coordination can be detected in some countries, especially in fields like agriculture, water, energy, biotech, climate change and health. However, the responsibilities concerning development and research policies are distributed among various ministries and agencies. There are potential goal conflicts in terms of different geographical foci, different thematic foci and different approaches. Some countries seems to be quite advanced in the effort to combine scientific excellence and development goals while others only start to look for synergies.

Monitoring and Evaluation of S&T Policy Implementation

Around 60% of the MS/AS who responded to the questionnaire confirmed that they monitor and/or evaluate the implementation of national policy measures supporting the internationalisation of S&T. Of those countries who do not monitor or evaluate, all but two replied that they plan to establish such activities. The scope of the monitoring activities, however, varies and formal evaluations are less frequent – with the repeatedly mentioned exception of the evaluation of the participation in the European FPs. 70% of the monitoring countries who responded the survey use internal evaluation panels and units as evaluators. Other types like external evaluation panels and contracts for evaluation studies with independent organisations are less frequent. The aspects most often evaluated are the number of participants, the budget and, in case of joint initiatives, the national returns. Around half of the monitoring countries evaluate the impacts and effects of the measures. Explicitly mentioned elements of such an evaluation include the degree of achievement of the goal of the meas-

ure, the achieved S&T results and the resulting co-operation structures. Information provided on the applied evaluation methods is scarce, some examples include the analysis of international and national data bases and the use of questionnaires for the ex post evaluation of projects and programmes. Only a few relevant evaluation reports are publicly available.

National Policy Measures towards International Cooperation of S&T Institutions

International S&T collaboration of research institutions has significantly increased in the last decade. Despite the fact that the majority of internationalisation activities occur on a bottom-up-basis, it is a regular practice of the MS/AS to support the internationalisation of S&T organisations established in their respective countries with a variety of policy measures. The growing importance of international cooperation is reflected by the high number of MS/AS which have intensified existing schemes and or initiated or plan new initiatives, which characterises a trend to treat the issue of internationalisation of R&D not anymore as just a pure 'add-on'-activity but as an emerging pillar of S&T policy making itself.

The overall rationale of the existing policy support measures is oriented towards a reduction of transaction costs for the participating (national) institutions, which result from international cooperation and asymmetric information. Measures in this respect include on one hand 'small scale funding' to cover for instance travel costs within international collaborative R&D projects and on the other hand information support services, including legal and technical advice, research promotion activities, partner search support, matchmaking etc. to reduce additional information related transaction costs. Another important approach is the permission of participation of foreign institutions in national R&D programmes, usually without funding. A trend towards more thematically focussed initiatives, mostly based upon national strengths, which are increasingly differentiated by target countries, can be observed. Small scale initiatives, which by now have usually centred around mobility, are more and more complemented by genuine research promotion activities to add critical mass and momentum to the internationalisation activities of R&D organisations.

National Policy Measures towards the International Mobility of Individual Scientists

The stimulation of international in- and outward mobility of individual scientists is one of the classical arenas of international S&T co-operation policies, not at least because mobility measures can also be implemented if available budgets are constrained. With the increasing acknowledgment of the crucial role of human resources for successful R&D and innovation, the issue of international mobility has received renewed attention also from a more exploitation-oriented perspective. The rationale behind is based on the insight that knowledge cannot be entirely codified and thus, in principle, accessed each and everywhere.

In front of this background, it is not surprising that 19 of 21 responding countries have national policy measures in place to enhance the mobility of researchers through governmental funds. In addition, bottom-up initiatives of agencies and other stakeholders exist. Most MS/AS target all types of mobility ('brain attraction', 'brain retention', 'brain connection' and 'brain circulation') with similar and usually high priority. A focus on brain circulation is often a top priority in countries with a rather high RTD performance, while attraction and retention of researchers is more frequently identified in countries with a less developed RTD system in order to catch-up. In general, however, a need, especially on the intra-European level, towards more comprehensive and balanced 'brain circulation' models rather than concentrating only on 'brain attraction' can be observed.

From the viewpoint of policy measures, four types stand clearly out in terms of frequency:

- the enhancement of individual mobility under S&T agreements,
- the provision of incoming fellowships
- the provision of outgoing fellowships and
- measures aimed to raise the attraction of domestic universities and research institutes.

These policy measures are complemented by other important ones, which are, however, not so frequently in place, such as the provision of return programmes or measures to decrease the administrative burden to obtain working permits. Many of the new or planned initiatives of MS/AS focus on mobility measures towards Third Countries, because intra-European mobility is to a certain extent perceived as being already covered under the FP. Joint European initiatives, such as the creation of researcher's mobility portals, the ERA-MORE-initiative or the implementation of the EU Directive 2005/71/EC ('visa package') are often mentioned as successful measures in this respect.

National Policy Measures towards Foreign Direct Investment in R&D

R&D has for long times been one of the least mobile activities of multinational enterprises (MNE) due to different factors of local 'stickiness'. Current evidence on flows of R&D suggests, however, that the global R&D business environment has changed due to intensified global competition and the need to innovate more quickly at different scale and scope. At the same time, barriers to the dispersion of R&D have decreased due to rapid developments in ICT and international regulation progresses. This results in emerging patterns of globally distributed R&D networks which are increasingly connected to the concept of 'open innovation'. At the same time, there are signs on a declining interest for inward FDI in R&D in Europe (especially by US based companies) and an increasing competition by emerging economies (especially China).

As a result both inward and outward foreign direct investment (FDI) in R&D is high on the political agenda of most MS/AS, although the R&D part is usually included in more general FDI polices. Most of the MS/AS have recently put in place or revised their policies with the aim to increase the country's attractiveness for inward FDI. The most frequently applied policy measures include the promotion of local strengths abroad and active recruitment of foreign companies, cluster policies to attract FDI in R&D, administrative support for foreign investors, provision of infrastructure, direct financial support and fiscal incentives.

Although only a limited number of countries have specific policy instruments in place to stimulate spillovers from FDI in R&D to the domestic (or local) R&D environments, there is a rising awareness to innovate policy measures in order

- to take advantage of inward FDI in R&D by means of embedding (former) high-tech enclaves with little knowledge diffusion in the local environment and to generate spillovers without hollowing out the local research base
- to capture the scientific benefits of outward FDI in R&D (back) to domestic R&D environments and
- to adapt policy measures to the rational of knowledge competition rather than cost competition.

Policy Measures towards the International Exploitation of Knowledge

The policy objective as regards the international exploitation of knowledge is to find a balance between protection and dissemination of knowledge. A large group of MS/AS have a balanced view on the international exploitation of research. Some have an open view and an almost equally big number has no clear opinion (yet) on this matter. No MS/AS has a closed approach. Among the countries with a balanced view, regulatory interventions in the field of IPR protection and exploitation are usually made on case-by-case basis (e.g. in certain high-tech domains). Most common, however, is the inclusion of IPR regulations in S&T and other relevant bilateral agreements. Specific measures to promote protection of knowledge generated by domestic universities and research centres are perceived with an increasingly important priority, but concrete measures are still rare.

A few MS/AS put a special focus on knowledge and technology (usually under the context of competitiveness and exploitation) within general programmes aiming to promote the internationalisation activities of their domestic companies. There are few cases with respect to developing countries, where governments of MS/AS encourage also a shared utilisation of new domestic knowledge in and with partners from developing countries. As regards the enhancement of domestic exploitation of knowledge produced in Third Countries only a few MS/AS have policy measures in place, mostly through means of technology licensing from abroad and international knowledge and technology scouting activities.

From a policy perspective, the issue of international exploitation of knowledge seems to be in an experimentation stage, confronted with insecurity and complexity, not at least because of the lack of reliable data, the need to cooperate across different policy spheres and the private ownership of many of the ongoing activities. There is, however, growing awareness that comprehensive measures are needed to enhance the domestic exploitation of knowledge produced in Third Countries and the exploitation of domestic knowledge on international markets. Possible ways to go into this direction include a stronger promotion of the rationale of the model of open innovation within funding programmes to provide more flexibility on how to use the granted money, to support measures designed to identify and acquire technologies and licences from abroad and to cooperate in a sustainable way with developing countries in the field of technology transfer and technology development for the mutual benefit of both partners involved.

Present State of Trans-National Coordination of S&T Policies towards Third Countries in the European Research Area

Trans-national coordination of MS/AS towards Third Countries in the field of S&T is already being practiced. Around three quarters of the MS/AS who responded the questionnaire apply mechanisms for trans-national coordination of S&T policies towards Third Countries. In addition, 60% perceive a strong or even very strong need for enhanced trans-national coordination. Two countries reported that they do not have any further need for trans-national coordination, one country reported a weak need and an indifferent assessment was given by three countries. The majority of respondents, however, indicated a strong need for coordination.

The major objectives for applying trans-national coordination are

- to share expertise and experience in order to gain information as well as to learn lessons in view of the challenges of international S&T cooperation and
- to undertake joint activities and to share efforts.

The latter objective is very often pursued under European initiatives.

In general, trans-national coordination is perceived as a means to strengthen and to add critical mass to national efforts, to overcome segmentation of singular activities, to avoid duplication of efforts and to increase the impact. The potential benefit of using already available resources of other MS/AS (e.g. agencies, strong research teams, specific equipment) to implement own national ideas or projects, e.g. in third countries, was not addressed yet.

In terms of coordination instruments, Community instruments were highlighted to be of most importance. Those instruments were partly introduced under FP6 (such as ERA-NET) and are presumably even strengthened under FP7 (Coordination and Support Actions, ERA-NET [plus] and INCO-NET). 18 MS/AS reported that they participate in community instruments which support the coordination of EU-Member States activities in the field of international cooperation with Third Countries (ERA-NETs, SSA). The second most often used coordination instrument is the one of sporadic bilateral consultations. Only seven countries make use of S&T counsellors to apply trans-national coordination and only three cases reported on regular bilateral consultations.

Reflection on Community Instruments to Enhance Policy Coordination of MS/AS

The community instruments are in general perceived as the most successful coordination instruments, because they stimulate learning and generate outcome and – from a more practical point of view - because they are tangible and provide an EU-label as well as funding, resources and commitment. MS/AS emphasised the importance of ERA-NETs and SSA, but slightly more ERA-NETs. Values attributed to SSAs include ‘flexibility’, ‘effectiveness’ and ‘door-opener for international contacts and experience’.

However, it should be stated that the majority of FP6 ERA-NET activities were not meant for the development of the international dimension of the ERA. There are 6 out of 71 Coordination Actions with an explicit focus on international cooperation (3 regional ERA-NETs and 3 thematic ERA-NETs). There is room for a more extended use of ERA-NETs. Joint initiatives in strategic research areas with programme owners in highly industrialised countries (USA, Japan, Canada) as well as joint initiatives with candidate and neighbouring countries (e.g. MEDA, Black Sea) are still missing. Complementing the ERA-NET scheme, there are some SSA and CA respectively CSA under FP6 and FP7, which are dealing with mapping and structural S&T issues in and with Third Countries. The knowledge obtained under these projects has, however, not been fully exploited yet. For this purpose special new information and dissemination channels should be developed.

In addition to the proven instruments, there is much expectation in the MS/AS related to the new INCO-NET instrument allowing a systematic bi-regional dialogue with major regions of the world. It is acknowledged, that existing coordination instruments like the Monitoring Committee for the S&T cooperation with the Mediterranean partner countries (MoCo) and the Steering Platform on Research with the Western Balkan Countries will be strengthened through providing operational and knowledge based tools. For the other regions, such dialogue structure can be enabled through the INCO-NET mechanism for the first time.

Finally, there are a number of Community instruments which are so far not well harmonised with MS activities including the S&T agreements between the EU and selected partner countries, the network of EU science counsellors in distinguished Third Countries and the participation of the EU and the Member States in international organisations. Here, the

respective community instrument could play a better integrative role to provide at least to some extent an umbrella for activities of the MS.

MS'/AS' Strategies towards International Organisations

From all international organisations outside of the EU, the OECD was generally perceived as the most important international body influencing S&T policy shaping, especially – but not only – from the OECD members among the interviewed MS/AS. UNESCO was mentioned as frequent as the OECD, but the priority value assigned to UNESCO is considerably lower than the one for the OECD. Although the influence of UNESCO is below average in general, it is usually significantly higher among the new EU Member and Associated States. All other international bodies rank with descent interspace, out of which FAO, IAEA and UNIDO are most often mentioned. Quite a high priority is assigned from a handful of MS/AS to WHO and – by countries which are members – to G8/Carnegie Group.

The human resources approach of the MS/AS towards an active participation in relevant international S&T bodies varies considerably. There are some countries who implement a wide spectrum of measures in this respect ranging from awareness raising on job opportunities to secondments of national experts paid by national funds. Other countries focus more on selected specific measures or assign a lower priority to this issue in general. Among the applied instruments an active delegation approach is ranked with highest priority, because of the personal and institutional increase of experience and knowledge. In addition, delegation enables the receipt of first-hand information and, thus, among other things, an early awareness on emerging new initiatives. Another important issue is to participate in decision-making processes as well as to learn from experience of other countries. It has also been mentioned, that an inclusion in decision-making processes of international S&T organisations increases the commitment and ownership at home (i.e. within the national policy making processes). In terms of assigned priority, this instrument is followed by the instrument of seconding national experts paid by national funds and measures to provide practical assistance to those experts, who will take over jobs in international organisations. The strategic value of seconding experts paid by national funds lies in the proximity to national interest and priorities. The still existing close link of seconded experts with and through their home institutions is seen as a major institutional asset in this respect.

Only a handful of countries reported that major changes in policy measures for a proactive participation in international organisations were implemented in the last years. The emphasis on new measures seems to be rather a result of a general process of allocating higher awareness to the issue of internationalisation of S&T than to be a singular response to S&T relevant international organisations.

Lessons Learnt from and Barriers for Cooperation and Coordination

In general, there is a clear tendency of the MS/AS for a closer cooperation on S&T policy level towards Third Countries, but cooperation and coordination needs to be built on national interests and to prove clear benefits for all parties involved. So far, this process has been driven by new Community instruments. However, there is still much room for improving the coordination of S&T policies starting with a more extensive and strategic use of established Community instruments (which to some extent still require some reshaping to meet the particular needs of international cooperation) and building on new instruments like, most prominently, the INCO-NET mechanism. In addition, the potential of policy coordination initiated by MS and AS in variable geometries without using Community in-

struments needs to be explored building on national interests, instruments and funding. In general the analysis shows, that harmonisation and consistency of the activities of the MS and the EU-Commission could be further enhanced for implementing a leading role of Europe in the process of globalisation and in global problem solving. Here, the interrelationship of S&T agreements of the Community and the MS, the interaction between the EU delegations abroad and Member States' embassies and the participation in international organisations are three pillars of major importance.

Despite a generally benevolent attitude also barriers for trans-national coordination exist. Most often mentioned are four dimensions in this respect:

- differences in national legislations and administrative regulations which make the implementation of trans-national activities more difficult,
- lack of coordinating capacities and resources,
- lack of awareness of national stakeholders on the importance of a coordinated approach towards Third Countries and
- other centrifugal factors based on competition between MS/AS or specific geographical, linguistic and cultural ties which call rather for unilateral than for coordinated bi- or multilateral interventions.

Other obstacles refer to a general but conscious reluctance against any forced coordination, no clear and measurable outcomes and recognition of benefits yet (input-output ratio, spill-over effects from international S&T cooperation), the lack of knowledge on areas of common interest with other MS/AS and cultural differences.

Enhancing Coordination of S&T Policies of MS/AS towards Third Countries

Building on the analytical part of the report and the OMC discussions, the following actions are proposed:

1. *Identifying the relevant targets for coordination activities*

   Cooperation and coordination should build on common interest and mutual benefit and seems to be possible in areas where a number of MS/AS share common goals such as research aiming to solve particular problems of developing countries, research aiming to solve problems of global impact, the transfer and promotion of European S&T standards and models, joint access to scientific resources in Third Countries as well as development and use of S&T infrastructure built around particular resources of Third Countries and in spheres where research is simply better implemented through collaborative research efforts than through national efforts only.

2. *Raising awareness of needs and benefits of coordinated S&T policies towards Third Countries*

   There are manifold addressees for awareness raising initiatives in this respect ranging from domestic S&T policy makers to the interested public. It is important to identify and disseminate good practice, preferentially based upon evaluations, via tailor-made instruments.

3. *Establish and improve instruments for a better coordination of activities*

   There are certain mechanisms and Community instruments already available and accepted to share and disseminate information, such as the CREST OMC working groups, ERAWATCH, the new INCO-NET platforms etc.. However, there seems to be room for

continuous improvement and the need to discuss the implementation of efficient management procedures and infrastructures for joint (programmatic) efforts of MS/AS towards or with Third Countries (eventually based on Art. 171/172). As regards practical opportunities for international collaboration of researchers from MS/AS with colleagues from Third Countries there are - apart from the presumably rare practical cases of international participation in Community instruments, a few specific initiatives or programmes of a group of MS/AS and Third Countries (such as BSEC or the Northern Dimension) and some opportunities under other international programmes - almost no appropriate frameworks. Lessons from existing bilateral schemes need to be learned and expanded towards programmatic multilateral approaches. Here, not only funding programmes are addressed (e.g. via ERA-NETs), but also other essential elements such as joint agenda setting, mobility aspects, intellectual property regulations and good governance in international S&T cooperation.

4. *Implement a proactive approach in international S&T initiatives*

   Referring to the economic and scientific capacity of the ERA, there is the potential to play a strategic role in international S&T initiatives implemented for instance on OECD or UN level. Here, building on European values and common objectives of its Member States, the global challenges should be addressed in first line, but additional European S&T agendas might be covered as well under the precondition, that the Member States share a common interest, which has to be explored and shaped by preceding strategic consultation processes.

5. *Ensure coherence towards developing countries and development policies*

   As regards synergies between S&T policy and development policy there seems to be more multi-level effort to assure coherence, consistency and synergy and to avoid duplications. Building S&T capacities in developing countries and implementing dedicated activities of 'research for development' should play a self-evident and prominent role in the MS' strategies to reach their ODA budget goals. By complementing and supporting MS' activities, the relevant Community instruments, most prominently the instruments of foreign assistance, need to be strengthened as well in this respect.

6. *Ensuring harmonised and consistent activities of MS and the European Commission*

   One of the present weaknesses of the ERA is its still existing fragmentation in many respects. To overcome these deficit mechanisms should be implemented to ensure synergies of S&T agreements of the Community and the Member States, to build a living network of the EU delegations abroad and MS' embassies and to identify areas of clear benefit of coordination between Member States and the European Commission in international organisations.

7. *Establish a sustainable strategic dialogue on the internationalisation of R&D*
   In order to support the development, implementation and evaluation of an internationalisation strategy for the ERA addressing both national level (through mutual learning) and Community level (through coordinated efforts), a strategy forum on international S&T cooperation with high-level representatives of the MS/AS and the European Commission with an adequate support should be considered. The mandate of such a forum might cover,

   - to define and regularly adapt specific common objectives of the Member States and respective priorities for Community action for the S&T cooperation with Third Countries,

- to monitor the implementation of respective activities of international cooperation at Community level with respect to consistent and coordinated approaches of Member States and Commission measures,
- to propose actions to the Member States and the European Commission,
- to exchange information on strategic issues of S&T cooperation towards Third Countries at MS/AS and Community level.

In summary, addressing the activities of the CREST Working Group it is proposed that Member States, Associated States and the European Commission consider the Working Group Report and its recommendations for further developing R&D internationalisation strategies both on national and on Community level and to draw conclusions for appropriate policy actions including amongst others:

- o to provide an appropriate umbrella to proceed with and deepen the strategic discussion on internationalisation of R&D resulting in a ***wider Community Strategy for internationalisation of R&D***, which is embedded in other Community policies
- o to arrange dedicated discussion forums on key policy issues including those questions, which are mentioned above
- o to prepare a better and transparent analytical ground for political decision making at MS/AS and Community level

Along that line, MS/AS and the European Commission should jointly take necessary action to further analyse the setting-up of a high-level ***European strategy forum on internationalisation of R&D*** for developing, implementing and monitoring the international dimension of the ERA on a regular basis.

Existing instruments on Community level such as the EU RTD Framework Programme should be applied as much as possible to further develop international S&T cooperation.

The full Analytical Report elaborates all the issues addressed above in more detail and complexity. It refers to specific experiences and activities of MS/AS and it features good practice examples in highlighted boxes. The full report includes also some essential annexes on lessons learnt from the S&T cooperation of MS/AS with China and the reflections of the working group on the Green Paper 'The European Research Area: New Perspective'.

Summary of Recommendations

Building on analytical work and the OMC discussion, the following recommendations are made **to policy makers in Member and Associated States**:

S&T Policy Strategies at the level of Member States/Associated States (Chapter 3)

i. develop comprehensive internationalisation strategies as integral part of national S&T policy. This would include national (core) objectives and priorities in order to make optimum use of the benefits and to properly address the challenges of globalisation. It covers the links to other relevant policies and requires national coordination between the different stakeholders involved.

ii. develop a methodology and establish an evaluation system for policy measures towards the internationalisation of R&D covering ex-ante evaluation, monitoring and impact assessment. Here, appropriate quantitative and qualitative indicators need to be developed. A European approach could be considered to allow benchmarking of national internationalisation performance.

S&T Policy Measures at the level of Member States/Associated States (Chapter 4)

Fostering international cooperation of S&T institutions (section 4.1)

iii. scale up available bilateral funding schemes for the internationalisation activities of R&D organisations through direct funding of collaborative research in addition to small-scale mobility-based networking measures.

Stimulating international mobility of individual scientists (section 4.2)

iv. develop more advanced instruments to foster a balanced brain circulation (considering multilateral schemes).

Attracting and making use of Foreign Direct Investments (section 4.3)

v. improve instruments which allow national S&T institutions and innovative firms to raise the full potential of spillover effects from inward and outward FDI.

Setting the frame for the international exploitation of knowledge (section 4.4)

vi. set a regulatory frame and support (incl. funding) activities of national S&T institutions and innovative firms allowing on the one hand better access to foreign knowledge and on the other hand a fair exploitation of domestic knowledge in Third Countries.

Coordination of R&D policies towards Third Countries between Member States and Associated States (Chapter 5)

It is recommended that policy stakeholders from MS/AS and the EC:

Identifying the relevant targets for coordination activities building on common interest and mutual benefit

vii. work-out a specific agenda with priorities for coordinated actions of MS and AS towards and with Third Countries in non-competitive areas through a strategic dialogue process involving the EU Commission as well and including Third Countries where relevant.

viii. identify barriers and threats for S&T cooperation with Third Countries and develop joint strategies to overcome them e.g. through coordinated policy approaches in terms of a common Community framework (addressing among other issues IPR, mobility aspects, access to S&T infrastructure and resources).

Raising further awareness for the needs and benefits of coordination of R&D policies towards Third Countries

ix. identify and disseminate information on success stories of coordination activities taken into consideration
- the outcome of an evaluation of existing coordination instruments on Community level (linked to recommendation *xiv*),
- national approaches to enhanced coordination with other MS/AS and
- joint activities in international organisations.

x. encourage a debate at ministerial level on the topics and instruments of enhanced coordination of S&T policies towards Third Countries.

Instruments for a better coordination of activities

xi. systematically extend ERAWATCH to major Third Countries as well as increase its efficiency through linking it with existing information services in EU MS/AS and upcoming services to be developed under the INCO-NET scheme.

xii. increase transparency on opportunities for trans-national coordination of S&T policies and coordinated joint S&T activities within European and international organisations, programmes and initiatives. It is proposed to develop and update a 'Directory of European and International Organisations', describing their coordination instruments and listing contacts in terms of respective MS/EC participants.

xiii. develop a light but standardised system of indicators and databases through a coordinated effort to capture and assess the diverse policy measures related to the internationalisation of R&D in order to generate comparable statistics and evidence-based knowledge for decision-making processes (linked with recommendation ii.).

xiv. contribute to the mid-term evaluation of FP7 through establishing an Assessment Group on coordination instruments for S&T cooperation measures with Third Countries. Come-up with recommendations for optimising Community instruments and for assuring their sustainability.

xv. analyse the interest of Member States/Associated States to establish a joint programme management institution for implementing multilateral funding activities targeting Third Countries. Together with the European Commission: Exploiting options of applying art. 171.

It is recommended that policy stakeholders from MS and the EC :

Implementing a proactive approach of the EU in international S&T initiatives through enhanced and coordinated participation in international organisations

xvi. set-up a strategic dialogue between Member States and the Commission. This dialogue would identify and regularly update common priorities and relevant emerging topics, which are of joint interest for European initiatives in international organisations. If appropriate it could provide a process for ad-hoc consultation between Member States and the EU Commission

xvii. entrust the European Commission with the participation in international organisations complementing MS participation - but not replacing them. If appropriate and legally possible, the Commission could represent the Community on the basis of positions previously agreed by the Member States on a case by case basis. The European Commission should report on their respective activities to the Member States.

Ensuring coherence and complementarity of European S&T policy towards developing countries and development policies at Member States and Community level

xviii. increase transparency through establishing a data base of ongoing and past activities of 'research for development' at MS/AS and Community level (emphasis on DCEC and ENP instruments);

xix. work-out a policy document on 'S&T and development policies' incl.
- synergies of S&T and development policy objectives towards Africa, South-East Asia, Latin America and the Caribbean
- recommendations on how to link instruments of S&T policy and development policy at MS' and Community level in order to exploit synergies
- criteria and respective proposals for joint activities of MS/AS
- scenarios, how to use ODA money for the upgrading of S&T structures in developing countries (through capacity building, institution building and research for development measures).

Here, the upcoming activities within the bi-regional dialogues implemented through the INCO-NET scheme should be considered.

xx. coordinate S&T related activities towards developing countries on MS/AS and Community level through establishing a 'Global INCO-NET' as a dialogue forum of respective stakeholders involving wherever appropriate stakeholders from developing countries.

Ensuring harmonised and consistent activities of Member States and the European Commission

xxi. establish an ad-hoc Expert Group of Member States and Commission Service to:
- analyse the relevance, practicability and the impact of present S&T agreements at MS and Community level and the need for a legal frame for S&T cooperation (in view of EU interest, barriers and threats for cooperation with Third Countries to be identified according to recommendation *vii/viii*)
- define the future complementary role and content of Community S&T agreements in relation to MS S&T agreements with Third Countries.

xxii. make optimum use of the established consultations mechanism between the Member States and the Commission in the negotiation phase of new Community S&T agreements and set-up a mechanism for an enhanced information exchange and coordination between Member States and the Commission on implementing ongoing S&T agreements.

xxiii. set-up Terms of Reference for local networks of EC, MS and AS science counsellors in Third Countries organised with secretarial support of the EU Delegation aiming at sharing information and good practice as well coordinating efforts (if appropriate).

Establish a sustainable strategic dialogue between Member States, Associated States and the European Commission on internationalisation of R&D

xxiv. set-up a strategy forum on international cooperation with high-level representatives of the Member States, Associated States and the European Commission in an appropriate form (i.e. by CREST) for developing, implementing and monitoring the international dimension of the ERA with adaquate support (see also vii and viii).

1. Introduction

The relaunch of the Lisbon strategy committed the Member States to undertake a series of new measures to achieve the ambitious targets adopted in March 2000. These measures, whose central tool is the setting up of national reform programmes (NRP) by the Member States, concentrate mainly on national activities: the performance of the labour market, sustainability of public finance and a favourable business and innovation climate are focal points within the NRPs. The role of science is widely recognised within this process, as the 3% target shows.

At the same time, the S&T systems of the Member States, Accession States and the European Union as a whole are faced with the challenges of globalisation. Globalisation with its numerous opportunities of cooperating world-wide opens ways to accessing knowledge, S&T resources and market opportunities abroad, and entails an immense potential in producing new know-ledge and ideas, simply through joining forces. Along that line an important aspect of the globalisation processes is a new division of labour developing at world scale, embracing also S&T. Today's key questions are how to benefit most of this phenomenon and at the same time how to reduce risks related to the globalisation process.

Improving international competitiveness, increasing the international attractiveness of the domestic science system, responding to international commitments to solve global problems and be economically competitive at global level are targets, which all Member States more or less have in common. Therefore, on one hand several Member States set up or are developing own internationalisation policy strategies in research and innovation. Another important European asset for taking more advantage of the opportunities of globalisation is to further overcoming the fragmentation of its research policy. The recently published Green Paper of the European Commission *'The European Research Area: New Perspectives'*[2] addresses as one important aspect, that 'the European Research Area should be … open to the world, and also S&T cooperation with partner countries should be steered in a coherent and policy-driven manner. A coherent approach towards international S&T cooperation, under the banner of global sustainable development, can assist in building bridges between nations and continents.'

In the frame of CREST, the Open Method of Coordination (OMC) and mutual learning exercises offer optimal instruments to compare, discuss and further develop the independent initiatives of the Member States. Additional value results from developing coherent or even coordinated and joint concepts for the international dimension of national research policies. This gives the opportunity to widen the impact of the national initiatives through multilateral efforts up to Community level.

With reference to the report '*Globalisation of R&D: linking better the European economy to foreign sources of knowledge and making EU a more attractive place for R&D investment*'[3] elaborated by Commissioner Potocnik's Experts Group on 'Knowledge for Growth' CREST set-up an OMC Working Group with the **mandate** to

1. collect and present Member States' policy approaches to internationalisation of R&D and innovation,
2. identify good practice, open questions and problems related to the development and implementation of a proactive internationalisation strategy based on national and Community experiences

2 Brussels, 4 April 2007, COM(2007) 161
3 Presented by the Experts Group on 4 April 2006

3. analyse the lessons learnt from institutionalised multilateral dialogues like the Monitoring Committee for the Mediterranean Countries or projects like the horizontal ERA-NETs and develop scenarios for future multilateral approaches of Member States based on OMC and building on national and Community instruments.
4. develop recommendations related to the international cooperation dimension of Member States Policies and programmes and, if appropriate recommendations for Community actions that reinforce Member States' actions.

Until September 2007 the CREST Working Group was asked to deliver

a. an inventory of recent strategic initiatives and instruments of Member States, Associated Countries and the Community targeting the internationalisation of science, research and development outside the EU
b. a draft outline of recommendations for the Member States
   - to reach better coordination of their international research policies - to find ways for joint action with regard to Third Countries
   - to reach better coherence of national and Community activities.

In order to fulfil its mandate the CREST Working Group implemented a **work programme** which included data and information collection and in-depth discussions on the basis of

- a standard questionnaire on Member States'/Associated States' Policy Measures for the internationalisation of S&T towards Third Countries outside the EU (22 responses),
- a standard questionnaire on Member States'/Associated States' cooperation in science and technology with China, which is considered as pilot case (20 responses),
- policy documents on the internationalisation of S&T of Member States/Associated States,
- mutual learning exercises through comprehensive country presentations to the CREST Working Group and thematic discussions among the Member States/Associated States,
- targeted information from the Commission,
- analytical documents and statistics of international organisations with particular emphasis on OECD activities,
- studies and other information on the internationalisation strategy of present and future European competitors (China as a pilot case).

The conclusions and recommendations in this report are built on matching the outcome of the different analytical elements and on consensus building within the CREST Working Group.

In addition, the CREST Working Group reflected on the above mentioned Green Paper of the European Commission 'The European Research Area: New Perspectives' in order to provide targeted input to develop the international dimension of the ERA.

This 'Analytical Report' summarises the results and recommendations of the CREST Working Group in order to

- increase the transparency among the Member States/Associated States,
- identify commonalities and differences in terms of policy objectives and implementation instruments,
- facilitate in-depth discussions on internationalisation strategies, respective joint activities of Member States/Associated States and appropriate Community instruments,

- initiate a knowledge based debate on S&T policy strategies of present and up-coming competitors in order to learn lessons and draw conclusions for a proactive cooperation with these countries,
- stimulate appropriate and efficient coordination activities at policy level to provide a common strategic umbrella for the internationalisation of S&T,
- provide an input for the debate on the ERA Green Paper published by the European Commission on 4 April 2007.

In **Chapter 2** the present state of discussion on drivers in the field of internationalisation of R&D and respective policy concerns addressed by national and Community S&T strategies are summarised.

Chapters 3 and 4 provide an overview and a comparative analysis of national policy approaches in the field of internationalisation of R&D and respective implementation instruments. A number of practice examples are given.

Chapter 5 deals with the present state of coordination of Member States/Associated States policies addressing the role of respective Community instruments and participation in international organisations. Acknowledging the findings of the previous chapters as well, recommendations on the perspectives of coordination of national policies are given.

Addressing open questions related to internationalisation of S&T and the respective policy framework, **Chapter 6** provides an outlook on major issues for in-depth analytical work, for targeted mutual learning among Member States and Associated States and for a priority future action at MS/AS and Community level.

Considered as a pilot case, **Annex (d)** gives an insight in the internationalisation strategy of China, representing one of the emerging international competitors for Europe and the present Member States'/Associated States' cooperation strategies. It describes lessons learnt and draws conclusions on implications for the ERA, both at national and Community level.

A reflection of the CREST Working Group on those issues raised in the ERA Green Paper, which address its international dimension, is subject of **Annex (e)**.

2. Drivers of internationalisation of R&D: Present state of discussion and respective policy concerns

Chapter 2 starts with a summary of present discussions on major drivers in the field of internationalisation of S&T in section 2.1. Respective S&T policy implications of these general trends are highlighted in section 2.2. From an EU perspective a distinction can be made between policy concerns as seen from the perspective of the Member and Associated States (section 2.2.1) and from the perspective of the Community as such (section 2.2.2). Section 2.3 provides first concluding reflexions. This chapter provides the general background of the CREST Working Groups' activities.

Main conclusions:

I. *The ability to have access to, to adapt, and to exploit new knowledge and technologies will be an important factor for countries/regions to maximise the benefits and minimise the drawbacks from the broad process of globalisation. Newly emerging economies are actively building scientific capabilities (both in terms of people and infrastructures) and their possibilities for 'catching up' are greater than before. S&T will be crucial in addressing critical issues like energy, environment, security and health at the global scale.*

II. *The process of internationalisation of S&T is driven by (1) strengthening research excellence and innovation performance through foreign knowledge and cooperation,(2) increasing the attractiveness to compete for R&D services and for FDIs, (3) preparing the ground for European innovations abroad and (4) responding to global problems.*

III. *The main policy concerns raised by the accelerated internationalisation of R&D differ depending on each country's current position on the global R&D map and competitive arena. Europe's position is particular given its risk to be incapable of reducing the technology gap with the US and Japan and at the same time being caught up by newly emerging economies (especially China). Also, it may not be neglected that Europe is the sum of quite heterogeneous (groups of) countries. The challenge emanating from this heterogeneity is that within Europe there is a need for flexible policy schemes that enable the differentiation needed. In any case, the importance should be stressed of not being lured into different protectionist measures. Protectionism has never been the answer for a better future. This is most certainly true also with the R&D off-shoring phenomenon.*

IV. *At the level of the Member and Associated States policy measures in terms of general framework conditions are no longer considered sufficient to answer newly emerging very concrete policy questions in terms of international collaboration in S&T and innovation, international mobility of researchers, support of new R&D activities via FDI and contributions to global problem solving including responding to the needs of the developing world. These broader objectives require the development of S&T policies in close relation with other policy domains.*

V. *At the level of the EU main concerns include the Community objectives, priorities and instruments, which add value to and complement individual MS/AS approaches, the coordination between MS/AS policies and the interaction between national governments and the European Commission and multilateral initiatives beyond the ERA.*

2.1 General trends and drivers in the field of internationalisation of S&T

Globalisation can be defined as growing interconnectedness reflected in expanded flows of information, technology, capital, goods, services, and people throughout the world. It is seen as an overarching ’’‘mega-trend’ which can be supposed shaping the world during the next decade. It will sustain world economic growth, raise world living standards, and substantially deepen global interdependence. At the same time, it will generate enormous economic, energy, demographic, environmental, cultural, security and consequently political convulsions. As such, its future is not fixed, and although the overall benefits are expected to be positive, the net benefits of globalisation will not necessarily be global.

The role of science, technology and innovation (and knowledge creation more generally) is emphasised in addressing critical issues like health, environment, energy, security at the global scale. Also, it is generally expected – and already reflected in many countries’ policies - that the greatest benefits will accrue to those countries that can access, adopt and exploit new technologies. This with the risk of an increasing gap between the ’’haves’ and ‘have-nots’.

The process of internationalisation of S&T is enabled by factors like the rapid development of a global information and communication infrastructure; digitisation and standardised tools; and fragmentation of the production process. In surplus, two more closely S&T related phenomena can be added. These include the fact that more countries are actively building scientific capabilities, increasing their scientific quality standards and participating in the global R&D community; and intensified cross-border S&T activities.

For the former, if so far the Triad regions (US, EU, Japan) were leading in terms of science and engineering on the world scale, currently countries like Brazil, Russia, India and China are emerging on the global stage and the possibility of emerging economies, including the Islamic countries, 'catching up' is greater than before. Also, the features of world collaboration are changing, as more of the world’s regions become active in S&T.

Addressing the report ‘*Globalisation of R&D: linking better the European economy to foreign sources of knowledge and making EU a more attractive place for R&D investment*’[4] elaborated by Commissioner Potocnik’s Experts Group on ‘Knowledge for Growth’ the following common drivers of internationalisation policies addressing research and innovation can be described:

- strengthening research excellence and innovation performance through a better access to knowledge abroad and an increased global cooperation with individual scientists, R&D teams, centres of excellence and science and innovation networks,
- increasing the attractiveness of the EU to promote European R&D on the world-wide market, to successfully compete for R&D services (contracts) and to attract more foreign investments in European R&D,
- preparing the ground for European innovations abroad,
- responding to global problems, international commitments and fostering the role of the EU as a community of values.

At the same time Europe is faced with challenges of globalisation and aims at turning them into opportunities like:

- world-wide but fair utilization of IP

4 Presented by the Experts Group on 4 April 2006

- brain circulation
- (re-)attracting R&D of European and trans-national enterprises
- European FDI.

Addressing those drivers and the challenges of globalisation, four main processes can be identified through which the internationalisation of R&D materialises[5]:

- International collaboration in S&T, where partners (firms and research institutes) from more than one country join their respective knowledge, skills and resources;
- The international mobility of S&T students and researchers according to individual career paths;
- The internationalisation of Technology Development and Innovation by firms who develop R&D activities internationally, simultaneously home and abroad driven by economic concerns;
- The internationalisation of the exploitation of research (e.g. by means of technology licensing and reverse engineering). This topic is closely related to the protection of knowledge.

Looking forward, it is likely that the internationalisation of S&T will continue and even accelerate – perhaps interrupted by periods of consolidation – resulting in a more global market of innovation resources. Although it should be noted that the least-developing world seems not to take part in this process yet.

Before relating policy implications to the above described trends, two important remarks need to be formulated concerning the internationalisation of S&T. Firstly, the internationalisation of S&T in many cases is part of broader strategic decisions by companies on production, marketing and mergers and acquisitions resulting in international flows and a redistribution of R&D capabilities. Moreover, R&D off-shoring is a modern way for global EU companies to leverage the creativity of the rest of the world. Modern global R&D includes partnering with a range of smaller R&D firms, universities and centres of excellence dedicated to more narrowly defined areas of research.

Secondly, the nature of research itself and the way it is performed is changing as well. Future technology trends will be marked by more trans-disciplinary and trans-institutional cooperation will gain importance. These phenomena are closely related to a tendency for higher reliance on external sources and networking. This is part of a fundamental shift in the way companies generate new ideas and bring them to the market, as is emphasised by the 'open innovation' paradigm[6].

2.2 Policy implications for Europe and for the Member and Associated States

The rise of an open innovation model in a context of globalising product and factor markets, increased international mobility of human resources in combination with changing international supply patterns of knowledge workers, and the expansion of the internationalisation of innovative activities in terms of increasing engagement in cross-border collaboration and global sourcing of knowledge from mainly large to also medium and smaller firms and pub-

5 OECD, 2006. The internationalisation of Business Research. Working Party on Innovation and Technology Policy, 7-8 December, the Kurhaus Hotel, the Hague, the Netherlands. DSTI/STP/TIP(2006)11.

6 Chesbrough, H. 2003. Open Innovation: The New Imperative for Creating and Profiting from Technology, Boston, Massachusetts, Harvard Business School Press.

lic research organisations, are major drivers increasingly affecting all aspects of science, technology and innovation policies. Moreover, international mobility of S&T, global challenges and responsibilities towards developing economies forces STI policy to go beyond its STI frame *strictu senso* (i.e. invoking other policy domains like e.g. economic and labour-market policy, foreign policy, development policy ...).

Whereas policy makers generally acknowledge that the internationalisation of R&D yields net global benefits (e.g. creating more optimal conditions for excellent research, while avoiding fragmentation, minimizing R&D duplication and generating more R&D funding, both public and private), many worry about the international distribution and intensity of such net benefits and associated structural adjustment costs. A recent study that was assigned by the European Commission has concluded that R&D off-shoring results in cooperation and collaboration that is beneficial to European Union as a whole, especially if the political measures are directed towards increasing the lucrative features of the European innovation environment and developing new ways for cooperation[7].

However, it would be wrong to consider the S&T situation homogenous across the Member States and the challenge emanating from this heterogeneity is that within Europe there is a need for flexible policy schemes that enable the differentiation needed. Subsections 2.2.1 and 2.2.2 deal with main policy concerns respectively from the perspective of the Member States/Associated States and at EU level.

2.2.1 Policy concerns at the level of the Member States/Associated States

Until recently, most of the Member/Associated States identified a number of general policy options for facing the challenges and opportunities raised by the internationalisation of R&D. These include solid macro economic policies and a healthy business environment, linking R&D policies with other relevant policy areas, a strong and vibrant research base, effective IPR and a well trained workforce, a framework of local conditions for R&D to create the necessary absorptive capacity, and last but not least adaptive and well trained human resources. But the acceleration in the process of internationalisation of S&T and the new trends as described in section 2.1 make policy needs pop-up in terms of answering newly emerging questions especially in the following fields:

1. ***Internationalisation of research and innovation***
    - How to improve framework conditions for international collaboration in science and research?
    - What policy approaches can be used to stimulate linkages between national innovation systems to access foreign sources of research and innovation?
    - How to set-up an international dialogue between science and policy stakeholders to solve societal problems resulting in necessary actions, frameworks or harmonised procedures?
    - How to respond to research infrastructure needs on a multilateral or global scale?
    - How to deal with the risk that increasing internationalisation of R&D erodes or 'hollows out' the domestic knowledge base in some countries?

7 The Implications of R&D off-shoring on the innovation capacity of EU firms, LTT-Tutkimus Oy, Helsinki School of Economics, 2007

- How does globalisation affect different categories of firms, e.g. SMEs and multinational enterprises? Has firm size become more important, as companies require economies of scale and scope, or is globalisation offering new opportunities for SMEs?

2. ***Mobility of researchers, notably foreign talents***
   - How can the international mobility of researchers be improved?
   - How to turn brain drain into brain circulation in a life long career perspective?
3. ***Support for R&D activities via Foreign Direct Investment***
   - How to increase the quality and the quantity of foreign direct investment addressing issues like attractiveness, specialisation and concentration?
   - Which other structural policies (e.g. education, labour market, social security, etc.) have an impact on the locations of R&D-intensive FDI?
   - How to increase beneficial returns from foreign owned R&D investments both located at home (absorption capacity) and abroad (technology sourcing)[8]?

Related to each of these fields and from a national policy perspective, until now most attention is paid to the attraction and making advantage of foreign S&T and a proper use of home-based generated knowledge. Although, there is a trend towards a growing focus on responsibilities in terms of responding to global challenges as well as to the specific needs of the developing world. From this perspective, policy concern is raised how home-based research can be used and – given their complexity – connected to foreign sources of knowledge in favour of solving these problems.

It needs to be taken into account that the main national policy concerns raised by the accelerated internationalisation of R&D differ depending on each country's current position on the global R&D map and competitive arena. Europe's position in this respect is particular in the sense that – despite the Lisbon agenda - S&T indicators (especially R&D investments by the business enterprise sector) indicate an incapability of Europe to reduce the technology gap with the US and Japan on the one hand, and a catch-up by emerging economies (especially China) on the other hand[9].

An in-depth overview of policy strategies and objectives as well as concrete policy measures towards the internationalisation of S&T at the level of the Member and Associated States will be dealt with in chapters 3 and 4.

2.2.2 Main policy concerns at the level of the European Union

The European Research Area (ERA) combines: a European 'internal market' for research, where researchers, technology and knowledge freely circulate; effective European-level coordination of national and regional research activities, programmes and policies; and initiatives implemented and funded at European level. Some progress has been made since the concept was endorsed at the Lisbon European Council in 2000. The European Research Area has become a key reference for research policy in Europe. However, there is still much

8 Globalisation of R&D: Linking better the European Economy to foreign sources of knowledge and making EU a more attractive place for R&D investment; Expert group Knowledge for Growth, 2006.

9 European Commission, 2007. Europe in the Global Research Landscape, DG Research.

further to go to build the ERA, particularly to overcome the fragmentation of research activities, programmes and policies across Europe. Also ERA will have to prove itself in a world of globalisation and open innovation.

One of the six topics presented in the recently published Green Paper of the European Commission 'The European Research Area: New Perspectives' concerns the opening of the ERA to the world. It is underlined that international S&T cooperation is considered an asset for the successful implementation of the Lisbon agenda.

Reflecting recent discussions on the international dimension of the ERA i.e. at CREST level and the key questions raised in the Green Paper, the following policy concerns at Community level can be summarised:

1. ***Objectives, priorities, instruments***

- How to set thematic and geographical priorities for a strategic internationalisation of the ERA? What are specific objectives for S&T cooperation with various groups of partner countries? Should complementary regional approaches be explored?
- What are the appropriate Community instruments for strengthening the international dimension of the ERA? How to make the best use of Community instruments (like S&T agreements) to provide an optimum frame?

2. ***Policy coordination***

- How to provide an appropriate Community frame for coordinating MS'/AS' policy measures in variable geometries fully respecting national interests?
- How to reach greater coherence between S&T activities and external and sector policies and instruments at Community level?
- How to ensure an effective and efficient interaction between MS/AS and the European Commission?
- How can neighbourhood countries be best integrated into the European Research Area to establish a borderless 'broader ERA' as part of the European Neighbourhood Policy?

3. ***Multilateral initiatives beyond the ERA***

- How to define common European agendas for international S&T cooperation addressing global issues as well?
- To what extend and how should the Community «speak with one voice» in multilateral initiatives?

S&T Policy coordination between the MS/AS is particularly addressed in chapter 6. A reflection on the key question raised in the Green Paper is the subject of chapter 7.

2.2.3 Concluding reflections

From the above presented insights it became clear that there is a need for more systemic policy answers towards the internationalisation of R&D. A first major challenge exists in investigating how the negative distributive effects of globalisation can be addressed without

foregoing the benefits of globalisation. A second challenge involves the responsibility towards global challenges and the specific problems of the developing world.

Some remarks can be formulated to obtain these challenges. Firstly, as the challenges are broader than S&T *strictu senso*, there is a need to develop more integrated and coherent policy approaches. This involves horizontal coordination across different policy areas (education, RTD and innovation, but also macro, trade, fiscal, competition and employment policies) at different levels of governance, regional, national and international. This involves a revisiting of national innovation policy instruments in light of the differential impact that the internationalisation of R&D has on their relative efficiency. Which types of policy instruments (e.g. IPRs) or mixes (e.g. tax incentives versus discretionary grants) are strengthened by the process of globalisation and which types, on the contrary, are weakened? Also questions arise about the character of programmes, for instance should closed programmes be opened up etc.?

Secondly, in order to respond to global challenges, there is a need for more coordination of policy initiatives between countries/regions, provided that the internationalisation process increases the influence of both global and local factors. Coordination needs to be built on mutual interest and should result in mutual benefit. This includes interested Member States, Associated States as well as third countries.

Finally, the process of internationalisation of R&D should not be solely driven by selfish interests or fear. For instance, the main fear from off-shoring business R&D outside the EU is the decreased innovation capacity of the European firms. This would in turn lead to sluggish aggregate productivity development and slower economic growth. The result would be lower economic welfare in the European Union as well as several negative short-term effects like reduced level of employment.

On the basis of a recent study by the EU it can be concluded that there are no real reasons to expect R&D off-shoring to lead to any of those[10]. Further, the study does not reveal any implications of European firms losing their competitiveness. In fact, both the survey results as well as the different econometric analyses and case studies suggest that EU firms have either maintained or improved their competitiveness by engaging in global R&D operations.

A key question for policy makers is under which conditions this process of internationalisation will gradually result in fair and efficient global knowledge flows respecting IPR as an asset for innovation. This will depend on both the appropriateness of global rules (e.g. relating to IPRs, trade and investment) and the soundness and compatibility of national policy responses. The majority of less developed countries fear the risk of being altogether marginalised in the process of R&D globalisation. The international community must avoid that such concerns inspire policies which not only would be inefficient at national level but would also result in a 'negative sum game' globally.

As noted in the introduction of this chapter, many of the questions raised here will be dealt with in more detail in the remainder of this report.

10 Ibidem 5.

3. Policy strategies at the level of the Member States/Associated States: A comparative analysis and good practice

Chapter 3 deals with policy strategies at the level of Member and Associated States. A brief overview of the current strategies of individual states will be given, as well as on a comparative analysis and examples of 'good practice'. Section 3.1 investigates to which extent comprehensive policy strategies towards the internationalisation of R&D exist and what the underlying objectives and priority settings of these strategies are. Section 3.2 highlights other than S&T policies and the wide range of stakeholders which are involved in the development of a national strategy towards the internationalisation of R&D. Special attention is paid to synergies and bridges between development and research policies. Section 3.3 has a closer look at the scope of the monitoring activities as well as the main evaluation criteria for the implementation of national policy measures supporting the internationalisation of R&D.

Main conclusions:

I. Over half of the MS/AS have already implemented a comprehensive national strategy on internationalisation of R&D. However, in most of the countries this is a recent and ongoing phenomenon that still needs to be embedded in a broader approach on globalisation.

II. Increasing the quality of research as well as competition and market access, and tackling global issues are the three main underlying objectives for policies towards the internationalisation of R&D. Selection criteria for partner countries and thematic priorities are closely related to these objectives. They can be classified along scientific, political and economic criteria and are increasingly applied based on systematic information gathering on S&T in Third Countries.

III. Foreign policy, economic and labour-market policy, development policy and environmental policy are major policies influencing national strategies towards the internationalisation of R&D. Despite differences in several countries in terms of responsibilities, geographical and thematic focuses between S&T policies and development policies, at least in some countries, there is a trend towards more coordination between both policy domains.

IV. Ministries, universities, non-university research and business organisations, research funding agencies, as well as S&T councils and other R&D advisory bodies, are major stakeholders involved in the development of the national R&D internationalisation strategy.

V. The scope of the monitoring activities for the implementation of national policy measures supporting the internationalisation of R&D varies among Member and Associated states. In general, formal evaluations are less frequent and internal evaluation procedures are usually applied.

3.1 Policy strategies, objectives and priority setting of internationalisation of R&D[11]

An overview on national strategies is given in section 3.1.1. It investigates in how far comprehensive national strategies towards the internationalisation of R&D exist and how they are integrated in the broader national policies towards internationalisation/globalisation. In section 3.1.2, the underlying objectives of these policies are analysed. A distinction is made between S&T related objectives (differentiating between policies focused at the internal attractiveness side and policies more focused at opening and connecting home-based research with research and technology in Third Countries) and broader objectives. 3.1.3 summarises present national approaches to the selection of priority partner countries and thematic priorities and identifies current priority partner countries.

3.1.1 Strategies towards the internationalisation of R&D

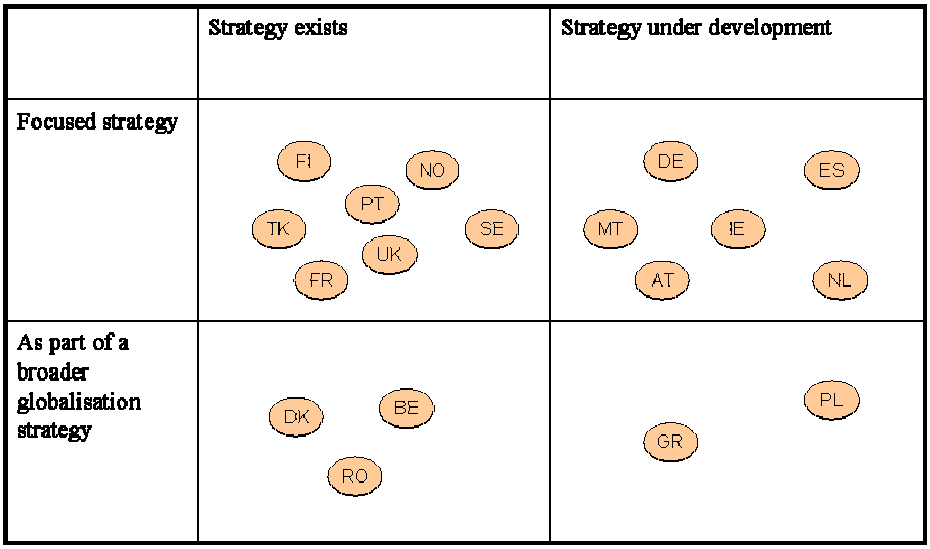
Ten of the 22 European countries providing information on their policy strategy towards internationalisation of R&D indicated that they have already a comprehensive national strategy on internationalisation of S&T. Out of these, three mentioned that this strategy is part of a broader strategy on globalisation (see Figure 3.1). The impressive number of eight of the remaining twelve countries stated that they are in process of developing a national strategy focused on internationalisation of S&T which might – at least partially – explain the great interest in exchanging views, opinions and information on this issue under the CREST Working Group with the support of the Open Method for Coordination (OMC). Just four countries indicated that they do neither have nor plan to have a national strategy on internationalisation of S&T (Cyprus, Czech Republic, Lithuania and Liechtenstein) for the time being. Norway is the only country which already has a focused strategy on international S&T at hand, but who prepares also a strategic inclusion of this matter into a broader globalisation strategy.

The reasons for the four countries who do not have and who are not developing any internationalisation strategy in the field of S&T are diverse: in the case of Liechtenstein and Lithuania they are connected to limiting structural issues of their own national research and innovation systems (e.g. no state support for R&D in Liechtenstein). In the Czech Republic it is simply not in the work programme and Cyprus seems to go well along with the existing instruments (especially bilateral S&T agreements and SSAs supported under the European Framework Programmes for RTD) without the need to develop a strategy as some kind of superstructure endowed with meaning.

The most recent changes regarding national S&T strategies on internationalisation (respectively changes regarding the development of such strategies) are usually confined to the inclusion of either new instruments (e.g. Denmark) or the expansion of existing instruments to other countries. Very often the latter issue regards the adoption of new intergovernmental S&T agreements (e.g. Sweden).

11 The information provided is a summary and integration of the Member States' (MS) and Associated States' (AS) policies in the field of internationalisation of R&D towards Third Countries (i.e. countries other than MS or AS). It is based on 'one page country-based notes on policies in the field of internationalisation of R&D' and on the 'Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D'. This information is delivered by the delegates in the CREST working group on internationalisation. It includes responses of Austria, Belgium, Czech Republic, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Liechtenstein, Lithuania, Malta, The Netherlands, Norway, Portugal, Romania, Spain, Sweden, Turkey and The United Kingdom.

Figure 3.1: Availability of an International S&T Strategy



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Other changes were that the internationalisation strategy on S&T itself is seen as most important recent change (e.g. Finland, Spain, UK); that a stronger focus on target countries is applied (Belgium, Portugal); that a stronger focus on target regions is applied (e.g. Malta's orientation on the European-Mediterranean research and innovation cooperation); that a stronger focus on priority topics is applied, eventually leading to specific 'target-country-strategies' (e.g. Germany's strategic partnership with the Russian Federation); the emergence of relevant sub-national strategies (e.g. the development of a global strategy for Wallonia).

Practice Example: UK's strategy for international engagement in R&D

The UK's Global Science and Innovation Forum (GSIF) published its strategy for international engagement in research and development in October 2006 fulfilling a commitment under the UK science and innovation investment framework 2004-2014. The strategy document summarises UK activities to support international engagement in R&D. The UK Research Councils provide the main support for international research collaboration. Other schemes and programmes are run by the UK government – particularly the Government Office for Science , UK Trade and Investment, and the Foreign and Commonwealth Office, as well as by Academies (e.g. the Royal Society) and other non-governmental organisations (e.g. the British Council).

The GSIF strategy sets out a framework of objectives to prioritise and coordinate the UK's international engagement in R&D:

- research excellence - collaborating with the highest quality research internationally and attracting the best scientists to work in and collaborate with the UK;
- excellence in innovation – encouraging UK companies to engage in international research and international companies to invest in UK research;
- influence – using science and technology to underpin international policy making and as a tool to foster bilateral partnerships; and

- development – using research and innovation in support of international development goals.

For each of these objectives, a number of countries are identified as a focus for coordinating UK efforts. EU countries are treated as a single region.

The strategy examines the available evidence base and provides recommendations for further improvements in the following areas:

- simplified access to public support schemes and consolidating the UK presence in key partner countries;
- linking world class UK universities with counterparts in China and India, and to attracting researchers to the UK and managing alumni effectively;
- improving coordination in bilateral relationships with priority countries, communicating strengths, and promoting scientific advice in international policymaking; and
- increasing the innovative nature of UK business - ensuring capacity to internationalise and access to knowledge and opportunities world-wide.

Work is now underway to implement the recommendations, as well as to improve the evidence base to inform further developments of the strategy.

In addition to recent changes, many countries envisage new initiatives, which underpins the dynamic with respect to internationalisation and globalisation of S&T. These planned new initiatives encompass a broad range, including far-reaching generic approaches (e.g. the Swedish government emphasises globalisation as a priority topic) as well as initiatives of a more technical, instrumental level (e.g. the Portuguese initiative to reinforce strategic university-cooperation with the USA).

Frequently indications on envisaged initiatives derive from the wish to implement the existing (very often new) international strategies on S&T and to make them operational (e.g. UK, Turkey or Belgium who are developing implementation action plans for international S&T cooperation). Also an assessment of the results and impact of the developed strategies is an issue envisaged for future consideration (Norway, UK).

Two countries which are in process of developing international strategies on S&T, namely Austria and Poland, did not report on any new initiatives envisaged. At least in the case of Austria this could be explained by the fact that already a number of instruments targeting international S&T issues are available, but that a strategic superstructure is missing.

Summary: National policy strategies towards the internationalisation of S&T

Austria's strategy towards internationalisation is mostly focused on Europe. Its bilateral and multilateral relationships with third states can not be separated from those of the EU. Major changes and new initiatives should make a point of becoming active in key regions like North America, China, India, West Balkans.

In ***Belgium***, a national strategy on internationalisation of S&T is under development as a part of a broader strategy on globalisation. Actually, the R&D policies of the different (national/regional) governments in Belgium pay attention to promotion of international cooperation in S&T; international mobility of human resources for research; and the attraction of FDI in R&D as part of a broader strategy to attract FDI in general. Major changes take place in the selection of countries for bilateral research cooperation and the development of a more global strategy. Also a new action plan for international cooperation is under development.

Denmark has an explicit globalisation plan (April 2006), which sets the overall frame for an ongoing integrated strategy with focus on education, research, innovation and entrepreneurship. The proactive strategy to gear Denmark for the challenge of globalisation incorporates 350 specific initiatives, which together involve extensive reforms of education and training programmes as well as research and entrepreneurship, and also substantial improvements in the framework conditions for growth and innovation in all areas of society. All the introduced initiatives are in a maturing process.

In ***Finland***, promotion of international cooperation is an essential element in launching and designing new programmes and in allocating funding to individual projects. Very recently the country has prepared a globalisation strategy including STI policies to be able to compete in global competition and to make use of globalisation.

In ***France***, a national strategy on internationalisation of R&D is under development by the Ministry of Higher Education and Research (MESR) and the Ministry of Foreign Affairs (MAE). Europe is, of course, the natural arena within which the regular activities of French research units ought to develop. Beyond the connections that French researchers naturally build with their foreign colleagues out of Europe to solve the problems arising from major issues in the sciences, French government intends to develop its international initiatives, by the use of six methods.

1. Partnership: The strategy of the MESR abroad has always been to form ties between French and foreign institutions to develop joint research projects when it is apparent that complementary interests exist. MESR thus seeks to give priority to structural initiatives, to coordinate initiatives abroad with the French research organisations and other scientific organisations and to systematically establish formal connections to ensure continuity in the programmes.
2. Hosting of the best foreign researchers in research units: To improve the process for hosting visiting researchers, MESR will make information about the procedures for hosting researchers more widely available abroad, strengthen French presence at recruitment forums and fairs in order to attract young foreign researchers to French laboratories, make better use of the various procedures used by the Ministry of Higher Education and Research and the Ministry of Foreign Affairs for hosting foreign students and coordinate the various procedures made available by the universities and local authorities.
3. Mobility: MESR seeks to support the mobility of researchers abroad in high priority projects.
4. Technology transfer: Academic research is directly related to economic development. The MESR will make efforts to incorporate technology transfer and intellectual property laws (agreements, seconding) into its initiatives with its foreign partners, in particular in the USA and in Asia.
5. Regional cooperation: International scientific cooperation is taking place more and more at the level of local organisations. MESR plans to collaborate with government, local authorities, universities, and foreign Ministries of Foreign Affairs to implement regional cooperation.
6. Education and training: Further education, especially at the Masters and the Doctoral levels, should be tied to scientific research projects. Foreign educational institutions will thus be supported in conjunction with research units which are carrying out priority projects of MESR.

Germany is preparing a national strategy on the internationalisation of S&T driven by the Federal Ministry of Education and Research defining specific objectives to be implemented through a set of instruments building on coherent and - if appropriate - coordinated joint activities of science organisations, innovative industries and policy makers. A ministerial draft is on the table reflecting the discussion with stakeholders from the science community and innovative industries. It is intended to assure coherence with at least foreign, economic and development policies. Also, Germany proactively has been implementing a variety of bilateral S&T agreements in some cases for decades. This is done by the Federal Government and includes priority setting based on German national S&T priorities and particular strengths of the partner countries. International cooperation is also an integral part of a growing number of national S&T programmes. Outside the scope of Federal programmes, but based on substantial public funding, international cooperation is implemented by a variety of intermediaries (DAAD, Humboldt Stiftung) and by the autonomous Science Organisations (DFG, Helmholtz, Max-Planck, Fraunhofer, Leibniz). Broad international cooperation schemes of German universities complete the picture. Major changes in policies include a stronger focus on specific target countries and priority topics (development of country strategies) like the strategic partnership with Russia and new strategic approaches towards China and India. A new initiative for the internationalisation of S&T is expected to be published by the end of 2007 building on specific objectives and implemented through a set of instruments building on coherent and - if appropriate - coordinated activities of science organisations, innovative industries and policy makers. As much as possible a coordination of different policy fields is considered.

Greece highly emphasises bilateral and multilateral S&T cooperation. Bilateral cooperation programmes (non EU) include: joint research projects, mainly covering mobility: Albania, Montenegro, Serbia; Armenia, Georgia, Russia; Egypt, Jordan, Tunisia, Turkey; China. Multilateral cooperation mainly occurs in the Western Balkan, Black Sea and Mediterranean regions. In the new programmatic period, international cooperation will be part of a broader strategy of globalisation.

Iceland has a globalising strategy for its science and business community in which participation in international S&T cooperation is implemented (but needs to be further strengthened). The focus is on the encouragement of leadership by Icelandic scientists in international cooperation projects; affirmation of financial resources for allocations to common funds in those eras where Icelandic participation appears particularly appropriate; enhanced efforts in Nordic S&T cooperation and in FP7; and strengthened cooperation with the Artic Council member states, the US, and Asian countries.

Ireland integrated the internationalisation dimension in its National Development Plan (focused around critical mass in science, applied research and technology competencies in strategic areas, sectoral research, commercialisation of research, strengthening of in-firm research and technology capability) and has a separate activity on internationalisation identifying current strengths, issues and challenges for the STI system in the international domain. Attraction of FDI and researchers from around the world as well as bilateral initiatives with US, China and India are important aspects. Recent major changes include the current preparation of a first comprehensive strategy dealing specifically with internationalisation. The strategy currently under development aims at fostering a more 'systematic' approach to international STI activities. New initiatives are likely to emerge but strategy will be as much about formalising and adopting a more strategic approach to the identification of countries, organisations and technologies where international linkages need to be strengthened.

In ***Malta's*** latest National Strategic Plan for R&I (2007-2010), the international dimension is strongly emphasised with the setting up of an institutional framework to take the European-

Mediterranean R&I concept forward. EuroMedITI is a business-driven initiative aimed at facilitating knowledge flows and exchanges between the North and South of Europe, extending to the southern Mediterranean. The prime focus will be on the development, adaptation, prototyping and dissemination of innovating technologies to address the specific needs of the Mediterranean region. The development of the EuroMedITI initiative can be seen as a means for generating sufficient critical mass for R&I.

Norway's White Paper 'Commitment to Research' from 2005 established internationalisation as an overall perspective in Norwegian research policy, meaning that international participation shall be emphasised in all research funding activities. Active participation in the European Research Area and strengthened bilateral cooperation was established as two of four focus areas in international R&D cooperation. The Ministry of Education and Research is as a follow up in the process of developing a strategy for Norwegian participation in the 7th Framework Programme and also a strategy for bilateral cooperation within the fields of science and technology, and education. This latter strategy will amongst others look into effects of bilateral agreements so far; measures to increase the effects; alternatives to bilateral agreements as a basis for cooperation; etc.

In ***Poland***, the internationalisation of R&D is one of the research policy's priorities, aligned with increasing the cooperation of the R&D sector with the economy, supporting careers of young scientists, mobility between science and industry and effective use of the EU structural research funds. The policy process is driven by the Ministry of Science and Higher Education. Also the main strategic document '*The National Science, Technology and Innovation Policy till 2020*' (2004) includes a part on internationalisation of the Polish R&D sector.

Poland has 52 S&T agreements with foreign partners: Europe (20), Asia (13), Africa (12), North and South America (7). Countries are selected on a case by case basis. Priority is given to cooperation with research organisations.

The following instruments are being used: special research projects implemented within international cooperation, provided that they are not co-financed with foreign funds, scientific research or development projects carried out under programmes launched by the EU or other international programmes, co-financed with foreign funds, bilateral research projects, financed from statutory funds (focused on researchers' mobility), programmes of the Minister.

In ***Portugal***, the internationalisation of S&T has been and still is increasingly a main driver of the S&T policy in the country. The country's strategy towards internationalisation of S&T is mainly focused on bilateral cooperation on S&T with selected countries in EU, Latin America, Asia, Africa as well as the USA. The country also participates in ERA-NET projects between MS and Third Countries and is active in multilateral cooperation on S&T by participation in international organisations or initiatives. Major changes and new initiatives are taken in the field of reinforcement of partnerships between Portuguese universities and top universities in developed countries (namely the United States).

Special research projects are aimed at financing projects carried out within the international programmes (i.e. COST, ESF, EUREKA, DFG, etc.) but can also be carried out within bilateral programmes. Each country offers funding to its participants along with their own rules. Such a small scale of funding has become Polish research sector's speciality. Examples of good practice: Polish – Singapore (2006) and Polish – Spanish (2006/07) programmes.

In ***Romania***, the National Authority for Scientific Research is in charge to carry out the international relationships policies in the field of research, development, and innovation. Policies in the field of the internationalisation of S&T are mainly oriented towards bilateral and multilateral cooperation activities. 14 bilateral cooperation programmes include joint research pro-

jects covering mobility with opportunities of SME involvement. There are traditional cooperation links with Asian countries such as China, Japan, Vietnam and Korea. In 2007 a bilateral programme with India is foreseen. Multilateral cooperation activities include the Central European initiative; Black Sea Economic Cooperation; ERA-NET projects. Also there is participation in projects from international organisations. Major recent changes and new initiatives include the governments' approval and near perspective launch of the associated National Plan for R&D and Innovation for 2007-2013 by the National Authority for Scientific Research.

In ***Spain***, the National Strategy for S&T for the period 2008-2013 includes the strengthening of the international dimension as one of the six strategic objectives established. The present R&D National Plan (2004-2007) includes a National Programme of International Cooperation in S&T and new initiatives will be taken in the field of bilateral calls with selected countries with specific S&T agreement. Attention is paid to management skills for international projects and engagement of researchers in international R&D.

In ***Sweden***, a 'Globalisation Council' was set up in December 2006. Part of it is to advise on a research strategy for Sweden in the global economy (report to be prepared for the next elections in 2010). It targets bilateral research cooperation with Japan, China, India, South-Africa and the US. Major changes over the last decade include the signing of six research MoU by the Swedish government since 1995. Before that, only the universities, research foundations and innovation agencies signed bilateral MoU at their levels - they still do. New initiatives are expected when the new government will present her research bill in autumn 2008. For this, globalisation is a priority.

Switzerland has planned to introduce a bilateral research strategy (budget € 35 million) with some priority countries (China, India, Russia, South-Africa, Japan) for the period 2008-2011.

The Netherlands orient international aspects of the Dutch STI policy towards the RTD programmes of the EU on the one hand and towards bilateral activities with Third Countries on the other. Cooperation agreements include China, Indonesia and Russia. New initiatives are underway but still in an early stage.

Turkey included the enhancement of international research cooperation in its National Science and Technology Strategy (2005-2010) and is drafting an 'International Science Technology and Innovation Strategy' (2007-2010). The country will also develop new initiatives in under an 'International STI Strategy Implementation Plan'. A main policy focus is on bilateral cooperation in terms of inter-government and interagency cooperation agreements with many countries in Africa, Asia, Central Asia and Caucuses, Middle East, Balkans, North America, Latin America. The country is also involved in multilateral cooperation.

UK see practice example box on page 13

3.1.2 Objectives for policies towards the internationalisation of R&D

The ***major national strategic objectives*** for dealing with internationalisation of S&T with Third Countries can be subsumed under three headings:

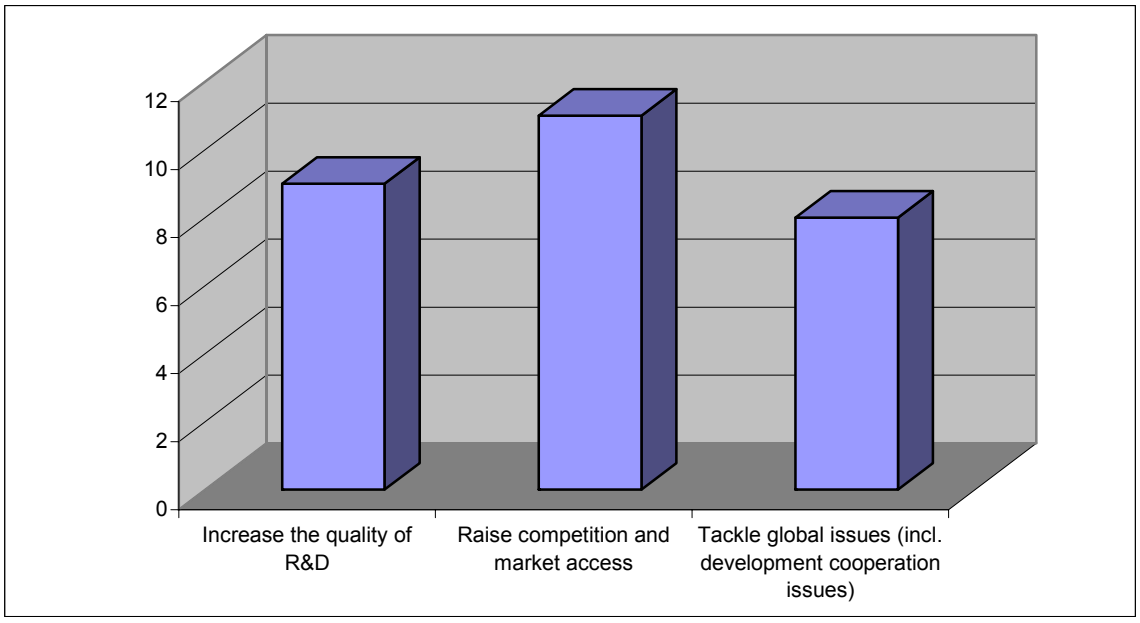
- the strive to increase the quality and absorption capacity of domestic S&T through international S&T partnerships allowing access to foreign knowledge and S&T resources (this subsumes the explicit aim to support 'excellence' but also the less ambitious aim to push-forward the internationalisation of domestic R&D and, thus, to raise the quality and absorption level in general);

- the effort to gain access to new markets and to increase the country's 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);
- the readiness to engage in solving global problems, which cannot be tackled in an efficient way by an individual country (in this sense a certain commingling with the strategy for sustainable development and the global development goals deriving from development cooperation, e.g. Millennium Development Goals, can be observed).

The latter objective includes activities like the development of broad relations with other countries through STI activities (Turkey); the attitude towards greater international responsibility for the solution of global problems (Germany, Sweden, Norway, Finland); contributing to the global development of knowledge, particularly in areas that benefit the least developed countries (Norway, Greece, Belgium, Malta); using research and innovation in support of international development goals (UK); the intention to take greater responsibility for the solution of problems (of the S&T systems) of prioritised developing countries (Austria, Belgium, Ireland, Portugal).

Although the attribution of country feedback was not always distinct, one can roughly summarise that in general all three dimension have been almost equally perceived as important motivations for the internationalisation of S&T with Third Countries (see Figure 3.2). Also it turned out that these objectives are not exclusive as most MS/AS have mixed objectives for their policies towards the internationalisation of S&T. Most priority, however, is addressed to the issue of facilitating access to foreign markets and raising competitiveness.

Figure 3.2: Major objectives of internationalisation of S&T with Third Countries



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Practice Example: Germany's strategic contribution to solving global problems

Germany follows a proactive approach in order to contribute to global problem solving. Being part of Germany's national S&T policy, major S&T programmes launched and financed by the Federal Ministry of Education and Research target global issues like climate change, sustainable management of resources, renewable energies, biodiversity and desertification. Such programmes are open for international cooperation and a huge number of institutions are involved in projects funded under these programmes. However, funding of foreign partner is only possible on subcontract basis.

In addition, the German Federal Government encourages and facilitates the participation of German higher education and S&T institutes in international networks.

Apart from national activities, Germany plays a strategic role in launching bi- and multinational initiatives targeting at global issues. First, most recently an initiative towards 'sustainable solutions for global problems' was kicked-off, aiming at inviting the BRICS countries and possible other emerging economies to enter into a respective dialogue on bi- and multilateral research agendas. This initiative is driven by the Federal Ministry of Education and Research.

Second, within the framework of G8 Germany has proposed to establish an International Research Dialogue (IRD). The main objective of the IRD is to support an internationally coordinated dialogue between science and policy. Especially in those cases where neither national governments nor the scientific community are able to solve problems or use opportunities on their own the IRD can boost international cooperation to commonly recommended necessary actions, frameworks or harmonised procedures. The IRD will respect the autonomy of science as well as the political mandates of national governments. It recognises the demand for coordinated scientific evidence of global challenges and suitable frameworks that can deliver new options based on scientific knowledge and an innovation perspective. The IRD will work on three areas of high priority:

- improving framework conditions for international collaboration in science and research;
- enhancing cooperation on global research infrastructure;
- identifying priority areas for international cooperation in science and research.

The IRD was integrated within the G8 Heiligendamm declaration. A first interim report should be presented to the next G8 meeting in Japan.

Practice Example: Objective to share costs and risks in large S&T investments in Norway

Norway's policy on internationalisation of Norwegian research includes an objective of sharing risks and costs of large research investments. Norway is an associated country to the EU Framework Programme, and puts great emphasis on participation in the programme, as well as in other international research organisations and programmes, such as CERN, ESRF, EMBL, EISCAT, EUREKA, ESA and COST. New and important knowledge is developed in international partnerships within these organisations, where cutting edge research takes place, and is considered important to the generation of new knowledge and innovation in Norway.

Alternatively, within the STI related objectives for the internationalisation of R&D, a distinction could be made between objectives towards the enhancement of national attractiveness

(inward objective) on the one hand and opening/connecting to research in Third Countries (outward objective) on the other hand.

STI-related objectives focused at increasing the nation's attractiveness (inward objective) include:

- the attraction of expatriate and foreign researchers (Finland, Turkey, Ireland, Belgium, Germany, UK, Sweden);
- the attraction of inward FDI in R&D (Finland, Greece, Romania, Ireland, Belgium, Germany, Norway – under development, UK, France, The Netherlands);
- continuous development of innovation environments (Finland, Germany);
- creation of world top-level education (Denmark, Germany);
- promotion of national science abroad (Switzerland, Germany, Norway – under development);
- enhancement of the knowledge society: turning research into new technologies, innovation and entrepreneurship (Denmark, Finland, UK, Germany, Belgium, Malta);
- offering ideal conditions for research cooperation in a broad range of S&T fields (Iceland).

STI-related focus at connecting the nation's S&T organisations with research outside the EU borders (outward objective) include:

- enhancing existing bilateral and multilateral relations in STI and establish new ones (Turkey, Germany);
- connecting national research(ers) into global STI activities:
  - in general (Turkey, Spain, Malta)
  - focused at frontier R&D or strategic research areas (Finland, Iceland, Portugal, Norway, UK, Sweden, Germany, Austria, Denmark, Ireland)
  - focused at excellence and greater value (the Netherlands) and complementing and underpinning trade and investment linkages (Ireland);
- higher involvement in (bilateral/multilateral) international cooperation (Finland, Turkey, Czech Republic, Greece, UK, Romania, Austria);
- enhancing international mobility of researchers (Greece, Ireland, Belgium, Germany);
- opening of the national research programmes to researchers from Third Countries (Greece, Romania, Belgium, Spain – under consideration, Portugal).

3.1.3 Priority setting in international S&T policies[12]

Following the presentation of national core objectives this section presents selection criteria for priority partner countries and thematic areas for international S&T policies and provides an insight into the selection process.

12 The information in this section is based on a thematic discussion within the 'CREST WG on policies towards the internationalisation of S&T' on the complementary issue of core objectives and selection criteria of international S&T cooperation towards Third Countries

Selection criteria

The selection criteria can be divided in six categories:

1. scientific benefits including improving quality and striving for excellence (12 counts);
2. political reasons including solving societal problems and contributing to development goals (12 counts);
3. gaining access to (new) markets, competition & innovation aspects (9 counts);
4. human factors (immigration of knowledge workers, brain drain, gain and circulation) (5 counts);
5. promotional activities for the national science system (3 counts);
6. geographical, historical, linguistic and cultural ties (3 counts).

It needs to be underlined, that in case of a partnership with third countries, the common ground is given by mutual interest and a mutual net benefit of the different countries involved. Here, the criteria mentioned above need to be applied by both/all partners and the various perspectives need to be considered. This basic principle is considered one of the assets of any cooperation.

The criteria for the selection of priority partner countries and respective thematic priorities can be classified along scientific, political, and economic criteria.

Regarding the scientific criteria MS/AS mentioned the present and future S&T potential in the partner country incl. the potential for partnerships in high-tech domains, the striving for excellent research on the basis of cooperation with leading R&D centres, benefits for participation together with Third Countries in EU Framework Programmes and better access to large international research infrastructures.

The main political aspects were contacts in line with foreign policies like bilateral agreements and umbrella agreements which act as 'windows of opportunities', to get doors 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 concerned potential future growth of the partner country, the partner countries' potential as business partner incl. the market for Multinational Enterprises reflected through the partner countries position on the various scoreboards (trend chart, global competitiveness report) as an example of a more evidence based approach.

Practice Examples: Quantitative evidence as selection criteria for partner countries in Norway and the United Kingdom

Norway, being a small country, is not in a position to cooperate equally actively with all countries on a bilateral basis. Important criteria in prioritising partner countries outside the EU/EEA include

- quality in research in a possible partner country,
- potential for research cooperation in emerging knowledge regions,
- existing cooperation in bilateral projects between research institutions/industry and the potential for further development, as well as
- regional and political challenges and opportunities, such as research cooperation related to the High North.

Based on these criteria and a dialogue between ministries, the Research Council of Norway, research institutions, organisations and companies, main partner countries have been identified. These priorities form the basis for priorities of bilateral state-to-state research agreements and bilateral S&T cooperation strategies, but with an open mind to new developments.

In the **United Kingdom**, country selection has been guided by available evidence recognising that some desirable metrics are not available; this is especially the case for the areas of the strategy addressing influence and development. Nevertheless, for the research and innovation areas, various quantitative measures are available, and give a reasonably consistent picture e.g. citations, student numbers, R&D expenditure and other business measures (patents, venture capital).

This information provided guidance to members of the Global Science and Innovation Forum (GSIF) in deliberations leading to the selection of the initial coordination focus for the strategy (see box in section 3.1.1). This information was used in conjunction with knowledge of existing and forthcoming activities and an understanding of where multiple overlapping interests and activities of GSIF members may work together most effectively to add maximum value in achieving the diverse aims of the strategy.

In addition, it was noted that these historic metrics do not reflect the current performance of certain countries, especially China but perhaps also India and Korea. More generally, metrics tend to indicate ability/capacity; they are less good at identifying future threats or opportunities.

Selection process: Building the information base for international S&T cooperation

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 (see also Figure 3.3 below):

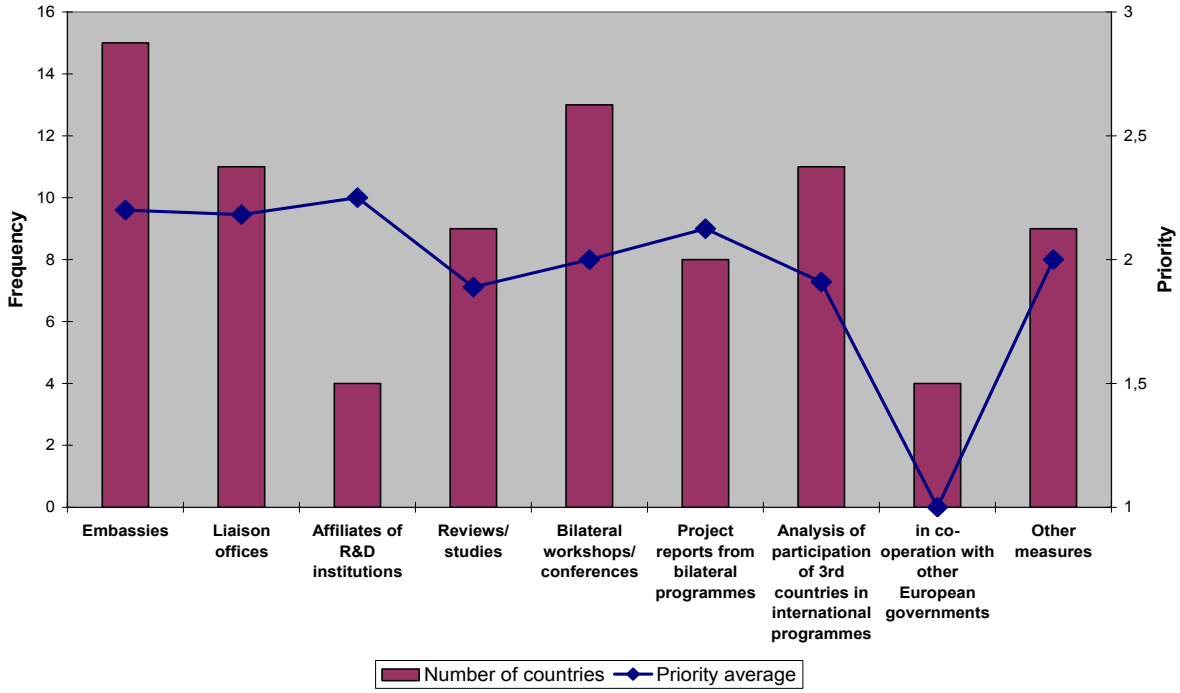
- embassies in Third Countries,
- regular bilateral workshops/conferences,
- national liaison offices in Third Countries and
- systematic analysis of participation of Third Countries in European/international programmes.

Cooperation 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 which 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.

Figure 3.3: Tools for systematic information gathering



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Priority averages for information collection measures in general, however, are significantly lower than for other policy measures towards the internationalisation of R&D. Only the four tools mentioned receive a priority average above medium priority, with only a minority of countries according a high priority to individual information collection measures.

Finally, it should be noted that a lot of countries stressed that many forms of international S&T cooperation 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.

Practice Example: Major changes in policy measures of Belgium – Flemish Region - towards collaboration in S&T with Third Countries – From top down to bottom-up approach

From this year onwards the previous programme for Bilateral Research Cooperation with 10 priority countries (selection mainly inspired by the Flemish Foreign Policy) has been discontinued. Selection of partner countries and the selection of the projects are performed by the Flemish universities (bottom-up system).

Priority Third Partner Countries

Across Europe, China (mentioned 16 times not counting references to the BRIC countries Brazil, Russia, India and China) and USA (12 times) are most often mentioned in the CREST questionnaire as priority countries for S&T cooperation, 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 cooperation partners. This pattern is line with patterns found in international research collaborations, scientific co-authorships and academic hyperlink networks[13].

The observable diversity of priority third partners beyond China, US and Japan seem 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 cooperation seems still dominated by the inter-EU collaboration. When asked to assess the importance of cooperation with different types of Third Country groups, usually only USA and Japan are considered as equally relevant compared with S&T cooperation with EU partner countries, while the cooperation with other industrialised Third Countries and developing countries is considered less important in the CREST questionnaire responses.

The INCONET (International Co-operation on Science and Technology Network) survey on bilateral international cooperation[14] shows that there are many bilateral agreements between EU countries and developing countries. If differentiated among main regions - in cooperation with Latin America and the Caribbean - France, Spain and Sweden stand out in number of agreements. S&T cooperation with Asia and the Middle East is frequent in France, Germany, UK, Czech Republic, Hungary and Slovakia. The pattern of S&T cooperation with Africa is different; here France has by far the highest number of agreements. When asked for the top 7 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.

Priority themes for S&T cooperation with Third Countries

The identification of priority themes for S&T cooperation towards priority Third Countries of the MS/AS revealed some interesting insights.

13 See for example Heimeriks and Van den Besselaar, Analyzing hyperlinks 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.

14 The INCONET (International Co-operation on Science and Technology Network) project was a Specific Support Action under the ERA-NET scheme aiming at paving the way to enable national managers and decision-makers to increase the weak level of cooperation among the international cooperation activities in S&T of the EU Member States. Through this project, a study of national programmes on international bilateral cooperation of MS with third countries was undertaken covering different target regions across the world. It was possible to establish a systematic overview of the type of approach of each MS in this respect, covering namely the following variables: type of entities involved, target countries, type of cooperation, type of actions supported and significant running activities. An approach to the strategy of each MS in the scope of these bilateral schemes was also tentatively undertaken. The focus of the analysis was the bilateral schemes covered by formal agreements between ministries, national agencies, research councils and entities in general in MS running bilateral programmes/schemes at national level. This project was coordinated by MEC (*Ministério da Educación y Ciencia*, Spain) and by GRICES (*Gabinete de Relações Internacionais de Ciência e Ensino Superior*, Portugal) in the scope of MCTES (*Ministério da Ciência, Tecnologia e Ensino Superior*). The survey allowing this study was conducted by GRICES and was finalised in 2005.

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 at highly aggregated levels, such as 'natural sciences' or 'life sciences', which can mean or hide a lot. Therefore, additional analysis at the specific levels of funded projects (e.g. within bilateral intergovernmental S&T agreements) needs to be carried 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 which 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 cooperation with the main partner countries (such as China, see Annex (d)) 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 cooperation with India in the field of biotechnology.

Last but not least, a few unique specialised cases need to be listed, for instance the obvious cooperation 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 strategy for sustainable development and the Millennium Development Goals.

3.1.4 Conclusions

A large majority of the Member and Associated states have implemented or are involved in the setting-up of a policy strategy towards the internationalisation of R&D. However, only a few countries integrated this strategy in a broader strategy on globalisation. As such, it is not surprising that the development of a strategy towards the internationalisation of R&D is an ongoing process and many countries envisage new initiatives underpinning the dynamics with respect to the broader process of globalisation (of S&T).

Increasing the quality and absorption capacity of domestic S&T; gain access to new markets and increase the own innovation system's competitiveness; and readiness to engage in solving global problems are the major national strategic objectives of national strategies towards the internationalisation of R&D. Most attention still is paid to objectives focused at increasing the nation's attractiveness. However, connecting and making use of research outside the borders gains importance.

An important element for an international R&D policy includes priority setting both in terms of thematic areas and partner countries. Along scientific criteria, also political and economic criteria turn out to be important. This creates the need to include other policy domains in the development of a strategy towards the internationalisation of R&D.

In order to set-up priorities, nations need to monitor S&T evolutions in different parts of the world. Embassies, bilateral workshops, liaison offices and systematic analysis of Third Countries are important ways to collect this information.

However, some remarks concerning the internationalisation of R&D towards Third Countries needs to be taken into consideration:

Firstly, it needs to be mentioned that overall trans-national cooperation is still dominated by inter-EU collaboration and that cooperation with Third Countries includes the USA and Japan as equally relevant for R&D cooperation. With this regard it is recommended to pay more and systematic attention to gain benefit from the cooperation with other groups of Third Countries like strategic countries of the neighbourhood regions (Russia, Ukraine, Egypt), emerging economies (China, India, Brazil, South Korea) and developing countries with particular emphasis on joint S&T contributions to address the global challenges including the strategy for sustainable development and the millennium development goals.

Secondly, many kinds of information gathering and priority setting towards thirds countries are still driven by a bottom-up process and in an ad-hoc way. Here, it is recommended to set-up a systematic, policy driven horizon scanning approach at Community level, building both on enhanced national activities and complemented by Community instruments and a policy dialogue with third countries.

3.2 Influential policies and the strategy development process[15]

The previously described diversity of answers and approaches towards the strategic objectives of policy strategies towards the internationalisation of R&D stems from the influence of a broad range of other than S&T policies. These policies are highlighted in Section 3.2.1. Taking into account the importance of global issues as a strategic objective for policies towards the internationalisation of R&D, Section 3.2.2 focuses on the extent to which national strategies towards scientific excellence are related with development goals towards Third Countries and what national mechanisms exist to exploit synergies between S&T and development policies.

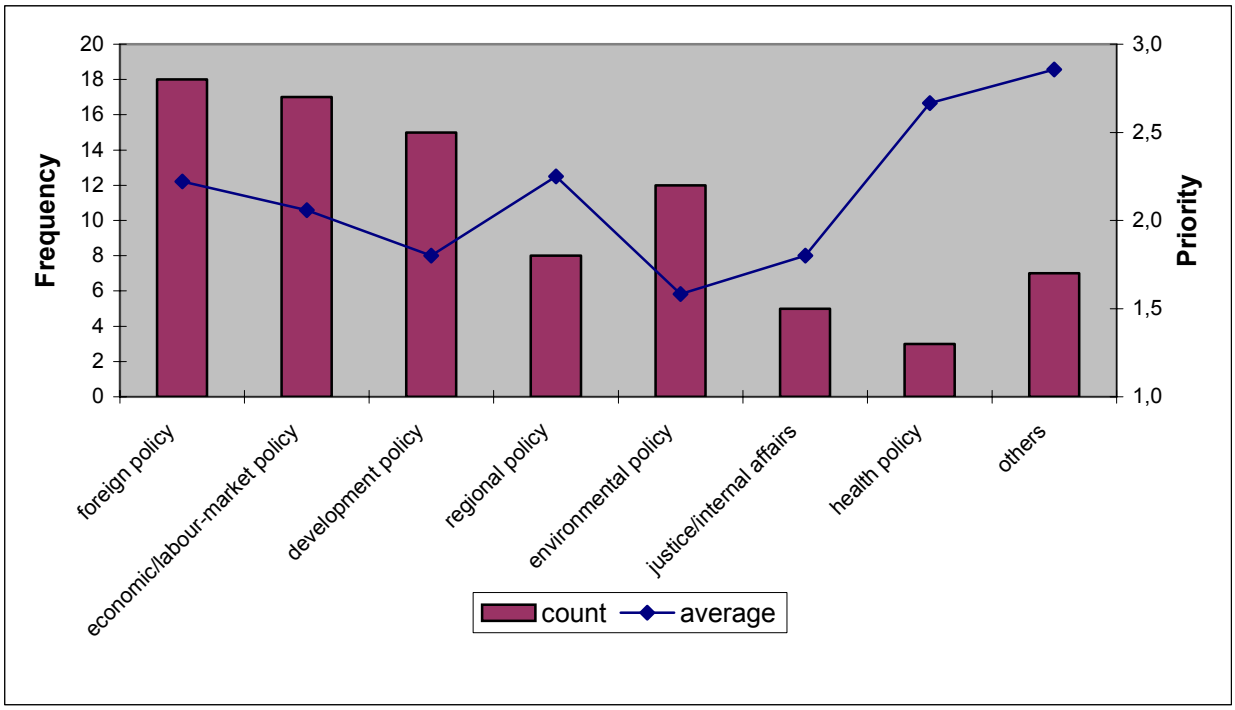
3.2.1 Influential policies for internationalisation of R&D

Figure 3.4 highlights the most often mentioned other influential policies for the policy strategies towards the internationalisation of R&D. These policies include: foreign policy (18 counts), followed by economic and labour market policy (17), development policy (15) and – with some distance - environmental policy (12). All other policy areas, such as regional pol-

15 The main basis for the analysis of influential policies on developing international S&T strategies and on strategy development processes are the answers to the questionnaire on 'National Policy Measures for the Internationalisation of S&T towards Third Countries outside the EU' sent out early March to all CREST Member States (22 responses received: 18 group members [Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Finland, Ireland, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Turkey, UK] and 4 non group members [Cyprus, Liechtenstein, Lithuania, Malta]. In addition, short country statements were provided by Austria, Belgium, Czech Republic, Denmark, Finland, Germany, Greece, Iceland, Ireland, Netherlands, Norway, Portugal, Romania, Spain, Sweden, Switzerland, Turkey and UK, as well as good practice reported by Romania.

icy, justice and internal affairs or health policy, are less important for the majority of respondents.

Figure 3.4: Other policies influencing the internationalisation of S&T towards Third Countries

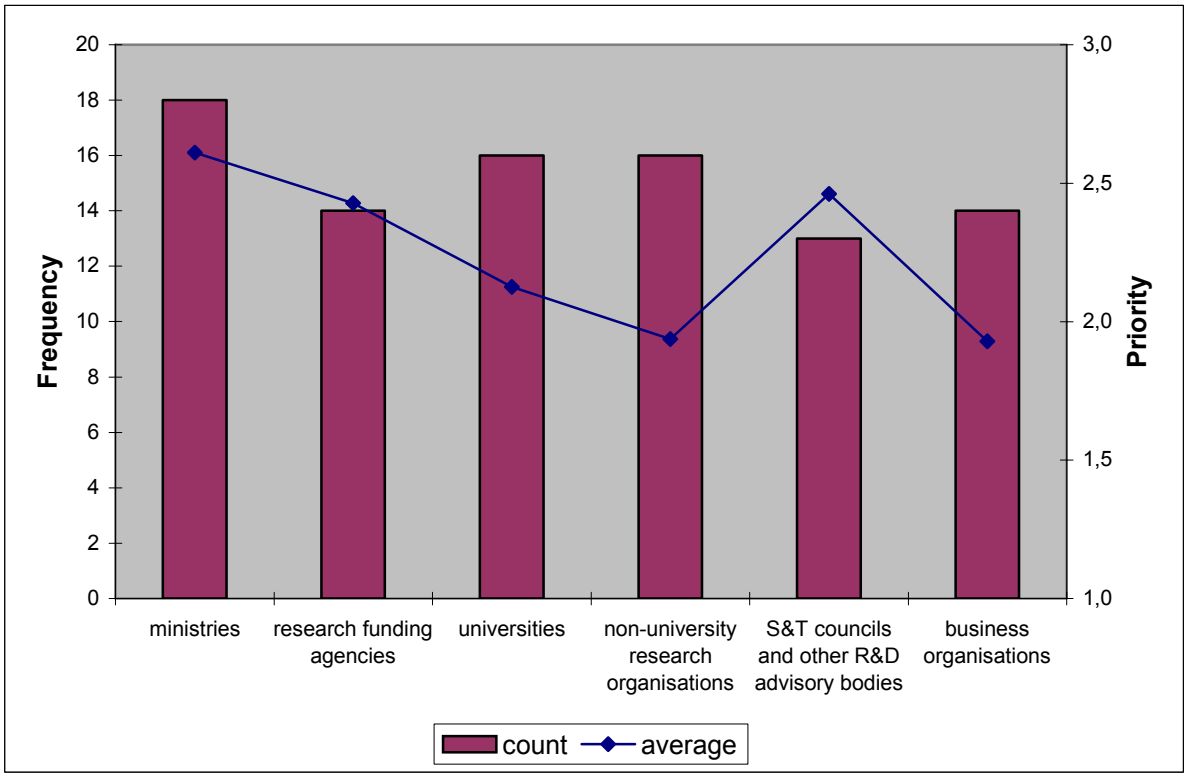


Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

However, as already experienced by other analytical appraisals in this report, specialised categories which are rather rarely mentioned sometimes receive the highest priority values. This is also the case as regards the most influential policy areas besides S&T policy. The highest priority is attributed to the residual category 'others', which was marked seven times, however, from three countries only. The following entries were subsumed under this category: agricultural policy (The Netherlands), higher education policy (The Netherlands), telecommunications and infrastructure policy (The Netherlands), policy on the High North (Norway), polar research (Norway), education and cultural policy (Turkey), trade policy (Turkey). Health Policy was generally seen as an important influencing category by France, The Netherlands and UK.

In all but a few countries, the coordination of the development of the national strategy for the internationalisation of S&T lies within the authority of either the relevant science ministry or another national S&T body (e.g. TÜBITAK in Turkey, the S&T Policy Council in Finland or the Malta Council for S&T). There are just a few exceptions which mirror different national jurisdictions and division of powers (e.g. in Greece the General Secretariat for Research and Technology is under the responsibility of the Ministry for Development; in Belgium there are federally organised assignments across different competencies). In the case of The Netherlands two ministries share responsibilities.

Figure 3.5: Involvement of stakeholders in the development of a national strategy for the internationalisation of R&D



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

S&T internationalisation strategies were or are mostly developed cross-governmentally, often by inclusion of important institutional stakeholders with representative functions (Denmark, Finland, Spain, UK) and individual experts (e.g. Austria, Portugal). Ministries were always included. Only in Poland and Romania[16], did the inclusion of ministries not receive the highest priority. In both countries, highest priority was assigned to universities respectively university associations. Universities and non-university research organisations (or their institutionalised representation bodies) were almost always included, but higher priority was attributed to the universities (see Figure 3.5). Business organisations were a little less involved and were also perceived as comparatively less important (same as non-university research organisations). Very high priority levels were attributed to the inclusion of S&T councils and other R&D advisory bodies (average value of 2,5) and research funding agencies (2,4). However, they were less often mentioned, which could be due to the fact that such organisations do not exist in each and every of the interviewed countries.

16 In Romania, the National Authority for Scientific Research was heavily involved in the process of strategy making. The National Authority, however, is closely affiliated with the Ministry and was – in division of labour with the ministry - the main organiser of this process (see practice example 'The Romanian Delphi' in the box below).

Practice Example: The Romanian 'Delphi'

During 2005- 2006, the National Authority for Scientific Research (NASR) promoted a project dedicated to the '*Elaboration of the National R&D and Innovation Strategy for 2007-2013*', which entailed a large scale consultation process, the 'Romanian Delphi ', where participants were invited to express their views and to define plausible road maps about the perspective on economic and social development and the particular evolution in the RDI field.

The project involved the direct participation of more than 800 specialists and the on-line consultation of more than 4500 persons, including the greatest part of the scientific community, representatives of undertakers, as well as significant personalities of both the S&T and the economic environment.

The final outcomes of the wide consultations and debates organised during this project were the two reference documents adopted by NASR for RDI policy planning for 2007-2013, the *'National Strategy for R&D and Innovation for 2007-2013' and* the associated implementation instrument – *'National Plan for R&D and Innovation for 2007-2013 (NPRDI II)'.*

Both documents emphasise the importance of developing the international, in particular European, dimension of research in Romania. The key underlying objective is to develop the human capital and the material base for research for providing the critical mass and for bringing them to a level comparable to the other EU member states.

The specific measures for strengthening international cooperation inlcude:

- improving the participation in international S&T cooperation programmes and projects, especially in R&D programmes running in the European space: EU FP7, including ERA-NETs, Technology Platforms and JTIs, as well as COST, EUREKA, ESA and ESF conducted programmes, NATO Science Programme, etc.;
- a better representation of Romania in S&T organisations and representative RDI bodies at the European and international levels;
- participation of the Romanian scientific diaspora in research projects to promote the Romanian R&D sector, and for evaluating projects, programmeems and policies.

The implementation of the S&T internationalisation strategies is very often organised by division of labour across different organisational constituencies: ministries (16 counts), public agencies (15), science organisations (12) and research councils (10 counts). No ministries are for instance involved in the implementation of the strategy in Malta and Sweden, where respective research or S&T councils - and in case of Sweden also science organisations - are solely responsible for the implementation. Poland and Spain are the only countries where only the ministry takes care on the implementation of the strategy. Business organisations are rather uncommonly involved in the implementation of the strategy.

In order to assure coordination as well as commitment of the various stakeholders from the academic and industrial S&T community as well as from the policy level, different methods are applied encompassing again a broad range of interventions. In Portugal, the relevant interaction is mainly done informally. Also Sweden, for instance, practices a very light approach, explicitly refraining from any pressure, but solely relying on the commitment of the involved stakeholders. Meetings and strategic monitoring are the main instruments applied in various countries (e.g. France, Germany). Reference groups are implemented in Denmark. UK follows a more structural approach by establishing the 'Global Science and Innovation Forum' (GSIF) as a central coordination body, whose secretariat is hosted by the Government Office for Science. However, the GSIF members continue to fulfil also other objectives according to their own mandates and priorities outside the GSIF strategic framework. Other realised re-

spectively planned structural coordination approaches include the participation of key stakeholders in the work of S&T councils (e.g. Finland) or the establishment of a special coordination body by the ministry (Spain).

3.2.2 International S&T cooperation between competitive advantage and development assistance: synergies, bridges of different spheres

During a thematic discussion the CREST WG discussed to which extent national strategies towards scientific excellence are related with development goals towards Third Countries and if so, what are the national mechanisms to exploit synergies between S&T and development policies? Also, it was investigated how the respective stakeholders cooperate.

In most countries responsibilities concerning development and research policies are separated and distributed among various ministries and authorities. The frictions and potential conflicts of goals between these two types of policies were illustrated by several countries by comparing the differences in responsibilities, geographical and thematic focus and approaches.

Practice Example: The Austrian case of Official Development Assistance and S&T

The Austrian Official Development Assistance (ODA) falls under the political authority of the Foreign Ministry and the operational authority of the Austrian Development Agency (ADA). S&T is mentioned in the relevant ODA programme documents, but in practice it is of marginal importance with the exception of tertiary and postgraduate scholarship programmes. The latter, however, consume a considerable share of Austria's ODA expenditures attributed to its educational sector programme.

'Real' scientific projects which can be assigned under the terminology 'research for development' are also funded by means of the Austrian Ministry of Science and Research channelled through the Commission for Development Studies, which belongs to the Austrian Academy of Sciences. The budget appropriations, however, are limited: the Commission for Development Studies has an operational yearly budget of around € 140.000, whereas the yearly budget of the ADA for educational ODA projects is around € 13 million out of which 8,8 million are spent on scholarship programmes. In addition, around € 200.000, are also spent on 'research for development' projects through ODA means.

The geographical ODA focus is on a few priority countries with a focus on least developed countries such as Rwanda, Ethiopia and Mozambique as well as on Western Balkan countries. The geographical focus of the Commission for Development Studies is less focused but has in practice a certain emphasis on Africa.

The thematic ODA focus is on the Millennium Development Goals (MDGs), the Education for All initiative and on higher education. By and large, also the research for development projects reflect main topics of the MDGs (e.g. agricultural research, health research, environment research, education, social sciences etc.).

A 3 million € pilot project of a duration of 3 years in Kosovo targeting at upgrading higher education and research to the benefit of social and economic development is jointly being financed and implemented by ADA and the Austrian Federal Ministry of Science and Research. It reflects the state-of-the-art on the potential of good governed systems of research, higher education and innovation in developing countries with a strong emphasis on capacity building and institutional development (including the establishment of institutions bridging between science and economy).

In some countries, there is a clear trend towards more coordination between development policies and international S&T cooperation. A number of countries indicated that research in the field of certain disciplines like agriculture, water, energy, biotech, climate change and health already included a certain component of development aid, if possible combined with excellence criteria. For example, Sweden has a target of 1% of GDP spent on development aid, of which 15-20% should be spent on R&D.

Practice Examples: Development assistance and S&T cooperation

In ***Belgium***, responsibilities concerning development policies – as it is the case for S&T policies - are highly fragmented and distributed among the federal and regional authorities. Also, *in globo*, expenditures performed in the field of development are relatively quite low (0,4% of GDP).

Nevertheless, the general link between development policies and S&T policies is one of complementarities mainly occurring through: (1) bilateral agreements; (2) mobility schemes for postdoctoral researchers; (3) dedicated advanced research institutes/units performing research in favour of developing countries; (4) participation in international organisations paying attention to development policies.

Bilateral agreements on S&T cooperation are implemented in a larger context of external political relations with Third Countries and are often initiated on an ad hoc basis and from a top down perspective. The collaboration is based on the principles of science sharing and mutual interest.

In case of relations with least developed countries cooperation strategies mostly take on board water, energy, sustainable agriculture, gender issues, environment and health, entrepreneurship and innovation topics.

Also, post-doc fellowships are granted to scientists from non-EU countries allowing them to perform research in Belgian host laboratories for a limited period of time (in general 6-12 months). The final aim of this is the development of sustainable networks and S&T cooperation between research teams in Belgium and in developing economies. Also, efforts are made to offer opportunities for (mostly African) foreign students to study in Belgium, and these opportunities are accompanied by return projects for researchers from the South.

Furthermore, due to the colonial past of Belgium, advanced–institutes/units performing research with a special emphasis on health, agriculture, environment and culture in the tropics have been created and are still supported substantially (examples are the Institute for Tropical Medicine; the Royal Museum for Central Africa; university departments covering topics related to development). Core funding is provided by the government while additional project funding can be obtained on the basis of peer review. Research projects can be performed in the developing country, in research institutes in Belgium or in collaboration between research institutes in Belgium and in the developing economy.

The Netherlands invest a considerable amount of money in science in development countries. These research projects are based on the principle of partnership, of mutual interest and mutual responsibilities. Some of the criteria for funding of these research projects are that research knowledge should also be spread in the region and that researchers from the development country should be involved. The Ministry of Economic Affairs strives primarily for excellence in international S&T cooperation. If this coincides with development goals towards Third Countries this is done as well, but this is not the point of departure. Regarding contacts with emerging markets the imperatives of sustainability and corporate social responsibility are taken into account.

WOTRO is the science division within the Dutch research council NWO which supports scientific research on development issues, in particular poverty alleviation and sustainable development. For its activities, WOTRO receives substantial funding from the Dutch Ministry of Foreign Affairs. Recently the Ministry of Foreign Affairs and the Ministry of Education, Culture and Science have improved their relationship in order better to harmonise their policy objectives with regard to research and development. Also the various research organisations involved in research for development have joint forces to develop a mutual strategy.

In ***Norway***, the White Paper 'Commitment to Research (2005) states that Norway has a responsibility to contribute to international knowledge development and the solving of common problems and challenges. Norway as a global partner in research is one of four priority areas in the national strategy for research and development. The White Paper points to the fact that 90% of all health research in the world is targeted at the needs of 10% of the world's population. A greater part of available resources must be addressed at solving problems in countries that themselves do not have the resources to invest sufficiently in research. The White paper states that Norway should contribute to the sharing of knowledge and inclusion of poorer countries in the international common research base, and make better use of knowledge developed in countries that have built research competence, such as South-Africa.

The White Paper points out two strategies:

- *Research should be more actively integrated as an instrument in international aid policy*; Research is to be more actively integrated both in development assistance funded by Norway in prioritised cooperation countries and in work in multilateral institutions, especially in the United Nations. At the national level, it is pointed out that research must contribute to reforms, not least in the education and health sectors. The aim is to contribute to economic growth, sustainable development and increased quality of life for the populations in question.
- *Norwegian research policy should to a greater extent address global issues and challenges related to poverty in developing countries.* One result is an increase in research related to global health in Norway.

Many countries stated that they also participate in research for development programmes of international organisations (i.e. European Commission, United Nations, FAO, WHO...).

In conclusion, a growing interest and attention to combine scientific excellence and development goals towards Third Countries can be identified. Some countries turn out to be already quite advanced in this respect; others only start to look for synergies.

3.2.3 Conclusions

Foreign policy, economic and labour market policy, development policy and environmental policy have been identified as major other influential policies for the development of a policy strategy towards the internationalisation of R&D.

The previously described objectives in terms of global challenges and responsibilities towards least developed countries are not fully reflected in terms of synergies and bridges between S&T policies and development policies. Although it should be noted that – at least in some countries - there is a clear trends towards more coordination.

For the implementation of an international R&D strategy, very often a division of labour is implemented between ministries, public agencies, science organisations and research coun-

cils. The commitment of the various stakeholders is ensured by nation specific methods encompassing a broad range of interventions.

Addressing 3.1.4 and 3.2.3, it is recommended that policy makers in Member and Associated States:

i. develop comprehensive internationalisation strategies as integral part of national S&T policy. This would include national (core) objectives and priorities in order to make optimum use of the benefits and to properly address the challenges of globalisation. It covers the links to other relevant policies and requires national coordination between the different stakeholders involved.

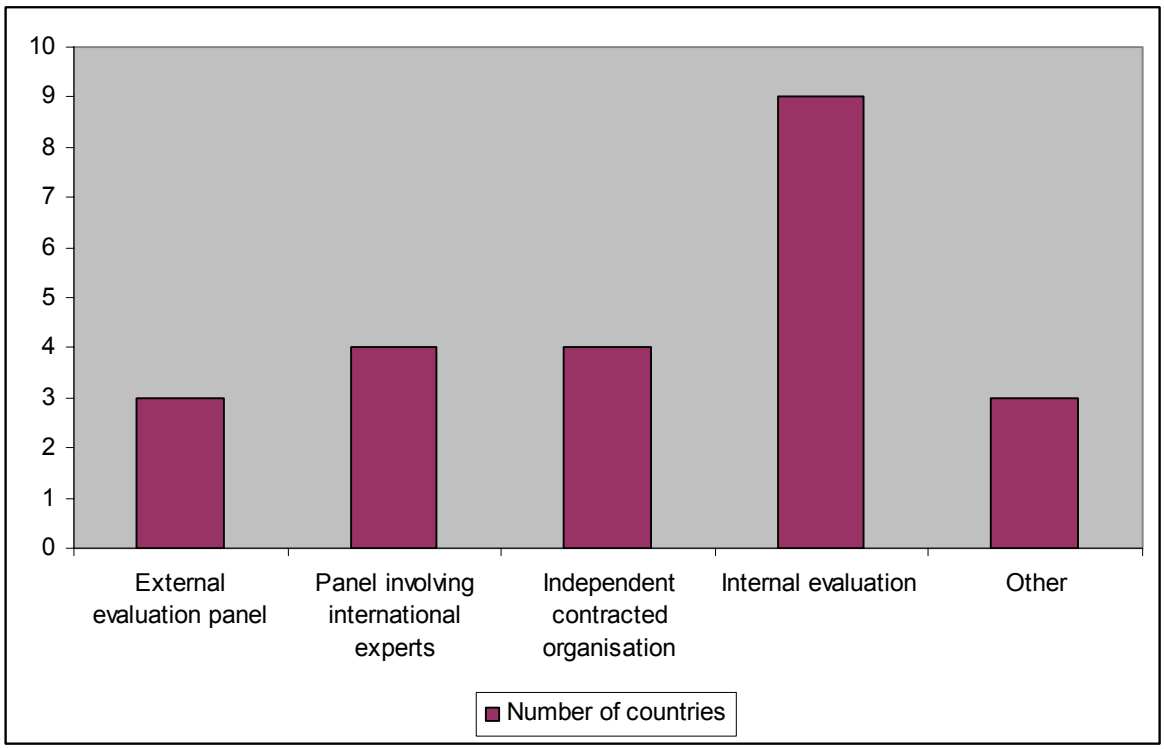
3.3 Monitoring and evaluation of internationalisation policies

Monitoring and evaluation are important parts of the policy cycle in order to ensure that policy goals are reached and measures are effective. This is confirmed by the results of the CREST questionnaire on policies towards the internationalisation of S&T. Around 60% of the responding countries (13 of 22) confirm that they monitor and/or evaluate the implementation of national policy measures supporting the internationalisation of S&T. Of those countries that do not monitor or evaluate, all but two state that they plan to establish such activities.

The scope of the monitoring activities however varies and formal evaluations are less frequent – with the repeatedly mentioned exception of the evaluation of the country participation in the EU Framework Programme. Norway and the UK intend to conduct an evaluation and impact assessment of their recently developed internationalisation strategies (see section 3.1). 70% of the monitoring countries which responded the survey use internal evaluation panels and units as evaluators (see Figure 3.6). Other types like external evaluation panels and contracts for evaluation studies with independent organisations are less frequent. More than 60% of the monitoring countries, however, use in some way external expertise. The involvement of international external experts – beyond bilateral committees of governments, which are one of the 'other' types of evaluators mentioned - is with three positive responses less frequent. Few evaluation reports on specific international cooperation measures are publicly available.

The aspects of policy measures most frequently evaluated are the number of participants, the budget and, in case of joint initiatives, the national returns. Around half of the monitoring countries evaluate the impacts and effects of the measures. Explicitly mentioned elements of such an evaluation include the degree of achievement of the goal of the measure, the achieved S&T results and the resulting cooperation structures. Information provided on the applied evaluation methods is scarce, some examples include the analysis of international and national data bases and the use of questionnaires for the ex post evaluation of projects and programmes.

Figure 3.6: Type of evaluators involved in monitoring and evaluation



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Practice Example: Evaluation of internationalisation means and mechanisms in S&T programmes in Finland

Enhancing internationalisation of research and development, innovation and technology based firms is among the key objectives of the technology programmes administered and financed by *Tekes* (Finnish Funding Agency for Technology and Innovation). In 2003-2004 an evaluation of internationalisation means and mechanisms of the technology programmes was carried out as a one-time effort covering altogether 64 technology programmes running during the time of review.

Due to the large scope of the evaluation and the complexity of the examined phenomenon, a multi-method approach was applied: a combination of international literature review, impact assessment of internationalisation in technology programmes by means of a survey as well as case studies of programmes. This was complemented with a construction of and analysis of a programme database consisting of all the available documentation on the technology programmes. Six case study countries were selected that appeared likely to provide relevant examples.

On basis of the findings from the evaluation some improvements have been made. The internationalisation targets and measures are defined already in the planning phase of technology programmes and there are linked to a desired impact. *Tekes* has also decided to accede to some open international projects (ERA-NETs, EUROSTARS) in which financing is based on a common pot in spite of the fact that opening up of the *Tekes* funds do not fit to present rules. Another impact has been that design of the technology programmes is nowadays based more closely on the *Tekes* general technology strategy.

The evaluation is accessible here: www.tekes.fi/eng/publications/Competitiveness.pdf

Practice Example: Germany's toolbox of evaluation methods and arrangements for international S&T programmes

Activities at the programme level:

Ex-ante and ex-post evaluation and monitoring with regard to bilateral programmes are carried out by the following means:

- **Regular Science and Technology Cooperation (STC) - meetings** with the partner countries (bilateral commissions, Midterm-Meetings, Thematic Managing Boards and thematic working groups) are used continuously for detailed reviews of past actions and projects.
- **Expert missions** shall review single projects and/or programmes in detail, but also to check whether new initiatives are needed. Missions result in detailed recommendations.
- **Regular round tables** of all relevant German organisations being active in the cooperation with single countries are used to spread information about the different activities as well as to assess ongoing activities and perspectives in terms of national cooperation goals, priorities and instruments.

Evaluation and monitoring at the project level:

For the evaluation of projects of international S&T cooperation (usually small scale funding for mobility and other transaction costs) a continuous process is in use, starting with the standard application submission and ending with the final report. Ex-ante evaluation is based on **project application forms** asking the applicants to indicate objectives and methodology, share of work among international partners, qualification of project partners and expected project impact i.e. where and how project results will be used. For the peer review usually a **standard evaluation form** will be used building on standard indicators as given in the call for proposals. The evaluation is based on expert opinions coming from national S&T administration.

Projects are continuously monitored based on **standard monitoring forms**.

In addition to a brief **final report**, ex-post evaluation applies questionnaires addressed to the outcomes of projects incl. scientific results (publications etc.), capacity building (training young researchers etc.), follow-up measures (e.g. application of results, new proposals).

Conclusions

Most Member and Associated States do or intend to monitor and/or evaluate the implementation of national policy measures supporting the internationalisation of R&D. The scope of the monitoring activities varies and formal evaluations are rather rare. Internal evaluation panels are most often used for evaluation. In terms of indicators, they pay attention to budgets, number of participants and national returns in a more or less elaborated manner.

It is recommended that policy makers in Member and Associated States:

ii. develop a methodology and establish an evaluation system for policy measures towards the internationalisation of R&D covering ex-ante evaluation, monitoring and impact assessment. Here, appropriate quantitative and qualitative indicators need to be developed. A European approach could be considered to allow benchmarking of national internationalisation performance.

4. Concrete policy measures at the level of the Member States/Associated States

Following the analysis of national policy objectives in chapter 3, chapter 4 provides an insight in the respective policy implementation measures. Here, four different dimensions are distinguished:

4.1 Measures towards international cooperation of S&T institutions[17]
4.2 Measures towards international mobility of individual scientists
4.3 Measures towards Foreign Direct Investments
4.4 Measures towards the international exploitation of knowledge

Each section contains an overview on applied policy measures including practice examples, a summary of major changes and new initiatives and dedicated conclusions of the CREST Working Group.

Main conclusion:

Figure 4.1 summarises the main findings on the four dimensions of measures applied.

I. *As regards the measures applied by governments to stimulate the international cooperation of S&T institutions, the status quo is predominantly confined on small-scale mobility support to cover – at least partially - the transactions costs of international cooperation activities. There is, however, a tendency towards less ubiquitous and less sub-critical support for the benefit of more targeted approaches. These are based upon thematic prioritisation with a more differentiated partner approach. A new trend in some MS/AS is the support for setting up sustainable cooperation structures in or with the respective partner country.*

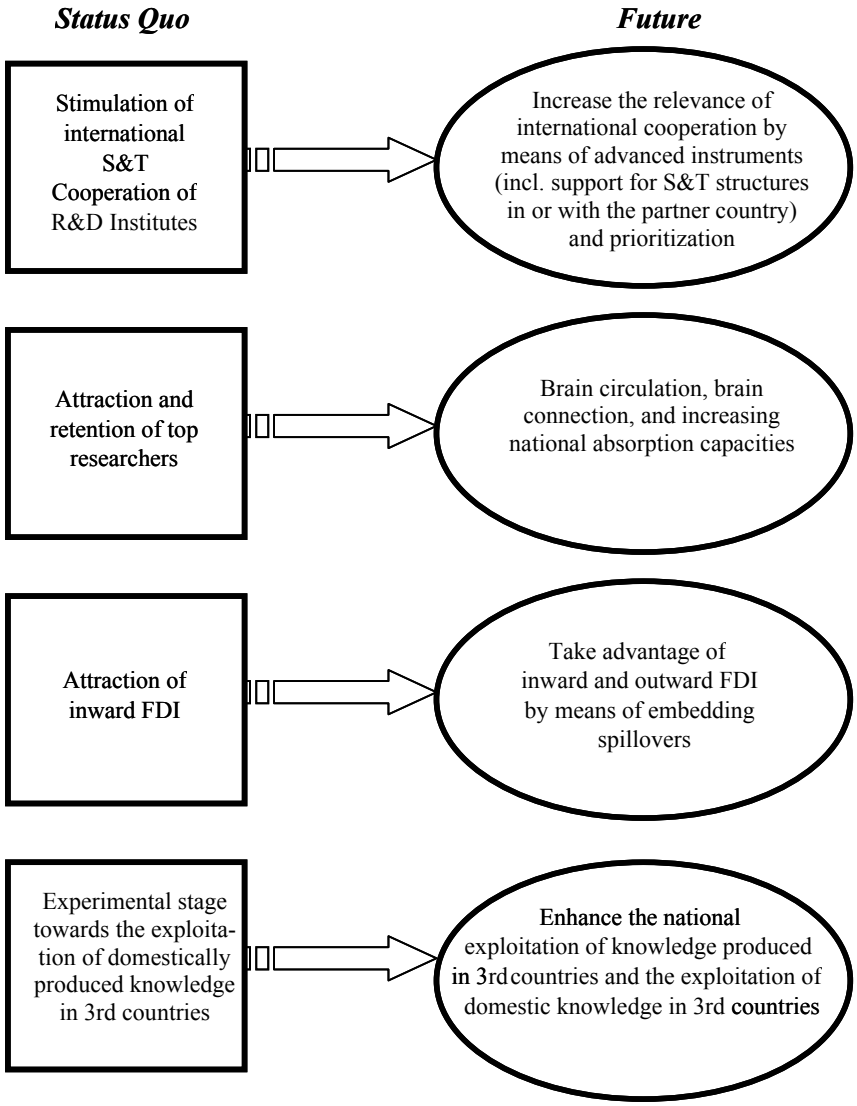
II. *In terms of support for the international mobility of researchers instruments to attract and retain top researchers are mainly applied for the time being. New models of balanced brain circulation are increasingly on top of the agenda. There is also a growing awareness for a sustainable connection of researchers who work abroad with their home institutions and countries to improve the absorption capacity of the home country.*

III. *As regards the issue of Foreign Direct Investments, we can witness a fast increasing effort to attract FDI in R&D but also more attention for spillovers created by outward R&D. Most probably, the next step will emphasise the creation of policy instruments designed to better link inward and outward FDI in R&D to the 'home basis' by means of an enabling environment for spillovers and a better embedding of foreign controlled R&D into local chains of production.*

IV. *Concerning the international exploitation of knowledge three policy views can be distinguished. A first group of countries are in favour of free dissemination of knowledge. A second one has no clear view on how to deal with this. And the largest group of countries relies on measures to regulate the modes of exploitation of domestically produced knowledge in Third Countries. There, the discussion centres on the issue of IPR protection. Emerging approaches aim to enhance the national exploitation of knowledge produced in Third Countries and the exploitation of domestic knowledge in Third Countries.*

17 Defined as universities, public research organisations and R&D companies

Figure 4.1: Evolution of Policy Measures



4.1 Fostering international cooperation of S&T institutions

Supporting collaboration with other countries through S&T organisations is considered an obvious and important form of internationalisation of S&T. There are several motivations for collaboration with Third Countries: to tap into the reservoir of excellent knowledge that is available at the global level, to access new markets and human resources and societal motivations related to e.g. development cooperation. A lot of international cooperation is therefore happening 'bottom-up', i.e. in form of agreements between research institutions or companies. Also S&T policy has recognised the benefits of increased international cooperation between S&T institutions and implemented a number of measures. These were the focus of the questionnaire.

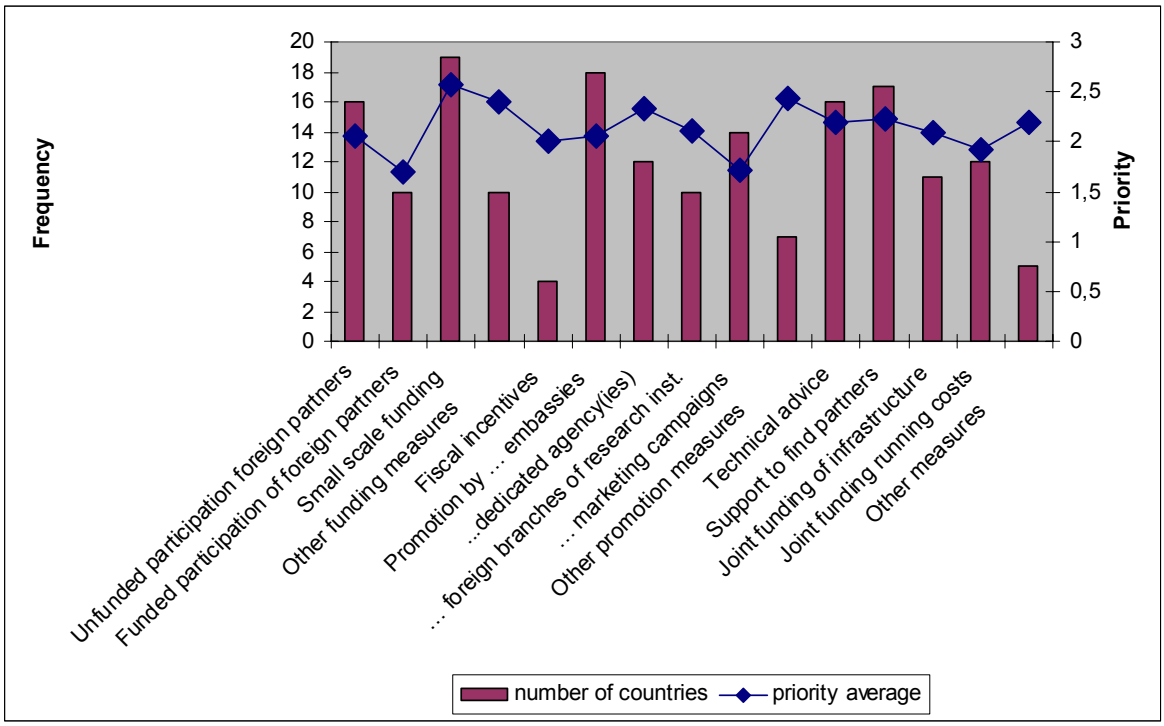
All countries in the survey indicate that national policy measures exist to enhance collaboration in S&T with (public or private) partner institutions in Third Countries. However, the range of policy measures and the priority given to these measures for increasing international

cooperation of S&T institutions varies widely across countries. Sweden, Portugal and Malta for example, indicate that few high priority policy measures exist. However, the reasons for low priority may vary across countries. In Sweden for instance, the instruments related to internationalisation are not designed and implemented at governmental level.

Overview on applied policy measures

The CREST questionnaire (see annex 1) shows that most countries have a range of measures in place. Most frequently used are 'small scale funding', 'promotion of national S&T by embassies', 'providing support to find partners', 'giving technical advice' and the possibility of participation of foreign institutions in national S&T programmes without funding (see Figure 4.2 below). Table 4.1 below gives an overview of the distribution of the use of specific measures among member states. For example, Norway indicates the importance of small scale funding because the scheme has proven to be successful as a way of initiating successful cooperation with partners in prioritised countries. Germany mentions the importance in support to find partners (by exploratory visits/delegations/brokerage) focussed on strengths of partner countries and mutual interest.

Figure 4.2: Pattern of institutional cooperation measures



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Small scale funding stands also out as top priority measure with an average well above 2.5 on a scale from 1 to 3 and is also most often mentioned first as example for successful measure because with little financial investment, considerable immaterial returns can be obtained (as Austria mentions). The second highest priority average of pre-specified measures is assigned to the promotion of the national S&T system through dedicated agencies, a measure that is not so frequently implemented.

Most measures have a bottom up character facilitating the choices of the research performers. However, there are some exceptions: Ireland uses joint calls for proposals in its R&D Partnership with the USA as the most significant initiative. It is underpinned by funding, has a strong governance structure in place, is based around a small number of niche areas and is driven by both scientific and political motives.

Table 4.1: Specific measures at MS/AS level to support the international S&T collaboration of public and private institutions

Country/ Measure	Unfunded project participation	Funded project participation	Small scale funding	Other funding measures	Fiscal incentives	Promotion by … embassies	… dedicated agencies	… foreign branches of research inst	… marketing campaigns	Other promotion measures	Technical advice	Support to find partners	Joint funding of infrastructure	Joint funding running costs	Other measures
AUSTRIA	x	x	x			x	x	x	x		x	x			
BELGIUM	x	x	x	x		x	x	x	x	x	x	x	x	x	
CYPRUS		x	x				x		x			x			x
CZECH REPUBLIC	x		x		x	x	x	x	x		x	x	x	x	
DENMARK	x		x	x			x	x	x	x		x		x	x
FINLAND	x	x	x	x		x	x	x	x	x	x	x	x	x	
FRANCE	x	x	x		x	x	x	x	x		x	x	x	x	x
GERMANY	x		x	x		x		x	x		x	x	x	x	
GREECE	x		x	x		x								x	
IRELAND	x	x	x	x		x	x		x		x	x			
LIECHTENSTEIN		x													
LITHUANIA	x		x			x			x	x	x	x			x
MALTA	x			x		x									
NETHERLANDS	x		x	x	x	x	x	x	x	x	x	x	x		x
NORWAY	x	x	x		x	x		x	x		x	x	x	x	
POLAND			x			x				x			x	x	
PORTUGAL			x								x	x			
ROMANIA	x		x	x		x				x	x	x	x		
SPAIN			x	x		x					x	x	x	x	
SWEDEN						x	x				x				
TURKEY	x	x	x			x	x		x		x	x		x	
UK	x	x	x			x	x	x	x		x	x	x	x	

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Practice Examples: Fostering international cooperation of S&T institutions

Austrian 'Science Offices'

In the early 1990ies Austria has established 'science offices' in many of the former 'reform'-countries (new MS) which, at their beginning, contributed to different kinds of well-tailored 'developing aid' measures in S&T from Austria, but soon became focal points abroad for presenting Austria as attractive research location, for supporting cooperative activities and initiatives at bilateral and/or regional level. They have turned out to be valuable (and 'cheap') instruments for the internationalisation of Austrian science, research and higher education.

These offices are mostly locally attached to universities, consist of mini-teams (1 director, 1 assistant/secretary) and spend most of their budget on small amounts of 'seed-money' for kicking off project cooperations, supporting mobility of scientists and researchers, preparing joint project proposals and organising awareness-activities like science-days and partnering events etc.

They also provide the Austrian ministry with information and latest news on S&T from their host countries and facilitate contacts between the respective ministries in Austria and abroad.

As concrete examples the Austrian Science Offices (ASO) in Sofia and Ljubljana should be named, which do not only deal with bilateral matters but, due to their expertise and experience, also have become important actors of Austria's S& T activities in the West Balkan Countries.

Support to find partners for S&T cooperation in the Czech Republic

There are two approaches:

1. Offers for cooperation coming from abroad

   This is done through the activities of the Czech Liaison Office for RTD (CZELO) in Brussels which publishes individual offers on its web page and sends them to relevant research bodies in the Czech Republic. The establishment and functioning of CZELO is financially supported under the project of the Ministry of Education, Youth and Sports (MEYS) and realised by the Technology Centre of the Academy of Sciences of the Czech Republic. The users evaluate the work of CZELO as very useful.

2. Offers for cooperation coming from the Czech research subjects

   One of the activities of the Czech National Contact Organisation (NCO), supported financially by the Ministry of Education, Youth and Sports (MEYS) and administered by the Technology Centre of the Academy of Sciences of the Czech Republic, is the *CzechRTD.info* portal, informing foreign researchers on Czech RTD structures and enabling at the same time Czech research teams to publish their proposals on cooperation in specific RTD and innovation areas. The database of offers was also published as a book in autumn 2002 and as a CD it was distributed on the occasion of the opening conference of FP6 in Brussels and other promotional events all over the world. This portal is considered to be an important tool for awareness raising. The number of daily visits at the portal is about 250, making almost ten thousand visits per year.

Strategic role of foreign branches of the Fraunhofer Society in Germany

One of the examples of a strategic approach to S&T internationalisation of Germany's S&T institutions is given by Fraunhofer. Fraunhofer is one of the major research organisations in Germany which receives a public institutional funding of about one third of its turnover. Due to its membership in the governing board of Fraunhofer, the German Federal Ministry of Education and Research is responsible for steering its activities.

Apart from its own locations in Asia and in the USA, the Fraunhofer-Gesellschaft with its about 50 institutes, which are working mainly in applied sciences and engineering, is engaged in a number of joint international activities. The Brussels office serves as a platform for dialog with European policy makers, with the additional functions of issuing public/official statements and providing information services.

Fraunhofer-Gesellschaft operates Representative Offices and Fraunhofer Senior Advisors in Asian locations. The Representative Offices form a bridge between local Asian markets and the Fraunhofer Institutes. They focus their activities on marketing and business expansion.

Fraunhofer USA, Inc. Headquarters in Plymouth is represented by a subsidiary in the USA which currently operates from five locations on the East coast. Germany, in particular, strives to keep pace with the American market and to stay abreast of new scientific and technological developments. Fraunhofer teams up with excellent scientific partners in the US to stimulate new ideas and work jointly on implementation of novel technology concepts. Scientific exchange is a vital means to initiate and reinforce this kind of cooperation. The current challenge is for Fraunhofer to make its profile better known and to improve the working environment for guest researchers. Cooperation with the US also means that Fraunhofer puts its services to the test: Technological developments made in Germany may be exported successfully to the US market, may require adaptation or may ultimately prove to be non-competitive in this market. Fraunhofer's experience indicates that in many cases a local partner – either from research or industry – is essential in adapting to the needs of its US customers and creating mutual benefit. Today Fraunhofer capitalises on the work of its own US subsidiary in providing a toehold between Germany and the US.

Small scale funding for international S&T cooperation in Poland

Small scale funding is a useful tool for fostering contacts between scientific institutions in cooperating countries. It helps initiate cooperation, which can be then further developed.

The Ministry of Science and Higher Education of Poland supports small projects of exchange of research staff between scientific institutions from two countries, based on executive protocols to agreements between Poland and other countries. This kind of assistance is treated as a first step enabling scientific institutions to start cooperation with foreign partners in a broader scale (e.g. FPs, COST, EUREKA and other intergovernmental schemes).

Another instrument designed to create a leverage effect is the programme of the Minister entitled 'Supporting international mobility of researchers'. It offers financing to Polish research institutions willing to delegate their young scientists to foreign research institutions in order to participate in research projects. After the period of 1-3 years delegated scientists are supposed to come back to their home institutions to share their experience and continue their research activities (brain circulation).

Portuguese International Partnerships with US Top Institutions

The recent partnerships between Portugal and top institutions in the US are important steps towards the strengthening of the Portuguese S&T in the scope of internationally relevant collaboration networks. In order to contribute to these objectives it was decided to foster a set of new diversified international partnerships with renowned research and education institutions world-wide to support the development of research and advanced education in strategic knowledge areas.

These international partnerships are defined for 5 years and may be renewed following an assessment of the results. A main target is to promote advanced training with high level quality standards in key areas in a transatlantic frame. An important feature of these partnerships is the role expected to be played by the industrial affiliates from the Portuguese side. So, these affiliates will be active actors of these partnerships and, in particular, will likely benefit a lot of the advanced training to be supported in a research atmosphere on areas of key relevance for the involved companies. Furthermore, the industrial affiliates may commit to allocate private investments to research projects in the scope of the fields covered by the partnerships.

More than € 130 million will be allocated as public funding over 5 years to the three partnerships between Portuguese and US partners.

The partnerships were launched in 2006 and 2007 with the Austin University, with MIT and with the Carnegie Mellon University in the USA. The Portuguese leadership of these initiatives has been taken by the Ministry of Science, Technology and Higher Education (MCTES-*Ministério da Ciência, Tecnologia e Ensino Superior*).

University of Austin – MCTES (Portugal)

In 2007 it was decided to enter into a long term collaboration to significantly expand interdisciplinary research and education in emerging technologies with an emphasis on the areas of digital media, advanced computing and mathematics, as well as on complementary areas of S&T commercialisation. The collaboration will be established through a joint 'International Collaboratory for Emerging Technologies' or 'CoLab', an international virtual institution with poles in Portugal and in Austin, Texas.

The pole of Austin (named CoLab@UTAustin) will involve the Colleges of Engineering, Communication and Fine Arts; and the Departments of Electrical and Computer Engineering, Mathematics, Computer Science, Radio Television and Film, the School of Journalism and research centres and institutes including the Institute for Computational Engineering and Sciences (ICES), Texas Advanced Computer Center (TACC), IC2 Institute and the Austin Technology Incubator.

The pole of Portugal (named CoLab@Portugal) will involve 15 universities, 2 associate laboratories, 4 science parks and 2 governmental agencies. Beyond this academic collaboration, a programme of cross national industry affiliations has been planned and a number of technology based firms have been committed to help defining the programme strategy and direction.

MIT–Portugal Programme

The long term collaboration with the Massachusetts Institute of Technology (MIT) is focused on research and education in two main areas of collaborative agreements: (i) management sciences (focus on technology based entrepreneurship) and (ii) research and education with a focus on engineering systems.

From the Portuguese side the network includes 10 schools of higher education and 7 different universities, together with a large number of research centres and associated laboratories, as well as state laboratories.

CMU – Portugal Collaboration

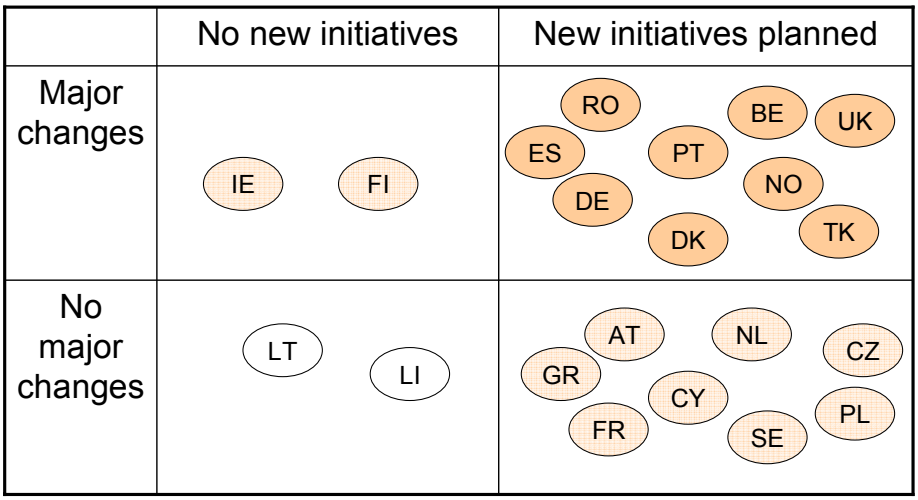
In 2007 a programme has been planned with the Carnegie Mellon University (CMU) to be governed by a single virtual institution with a focus on research and education: the Information and Communication Technologies Institute (ICTI) with two poles, namely the ICTI@CMU resident at CMU and CTI@Portugal, resident in Portugal. The institute has a unified administration. From Portugal 12 different universities, 8 schools of higher education together with a large number of research centres and 4 associated laboratories are involved. From CMU, 6 colleges, 8 departments and 6 research centres and institutes will be mobilised.

The CMU-Portugal industrial affiliates will provide the mobilization of companies' effort with the goal of fostering new research consortia in collaboration with CMU and Portuguese research groups leading to new frontiers of transatlantic collaboration in science and technology.

Major changes and new initiatives

In general, the results of the questionnaire indicate an increasing importance of international collaboration of S&T institutions. This growing importance is reflected in the number of countries that have planned new initiatives (see Figure 4.3). The results indicate a very dynamic development in policy measures related to internationalisation. The majority of countries indicate major changes in the last year and all but four of the responding countries plan new initiatives.

Figure 4.3: Dynamics of changes in collaboration policy measures



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

An example of major changes which reflect the growing importance of collaboration is the position of Norway, who states that international cooperation in research, both with countries in the EU and with Third Countries outside the EU/EEA, has been given increased emphasis, for example North America, China and India. Correspondingly, as a new initiative a bilateral

S&T agreement with China is planned. Greece mentions as new initiative that in the new programming period 2007-13, all S&T and innovation actions will be open to cooperation with both EU and Third Countries partners.

Conclusions

It is a regular practice of the MS/AS to support the internationalisation of S&T organisations established in their respective countries. Despite the fact that the majority of internationalisation activities occur on a bottom-up-basis by the RTD organisations themselves without any government intervention, a range of national policy measures exists to enhance international S&T cooperation. These measures vary widely across the MS/AS. In general, however, the overall rationale of these support measures is oriented towards a reduction of transaction costs which result from international cooperation and asymmetric information. Therefore, an additional financing to balance transaction costs is targeted. Measures in this respect include on one hand 'small scale funding' to cover for instance travel costs within international collaborative RTD projects and on the other hand information support services, including legal and technical advice, research promotion activities, partner search support, matchmaking etc. to reduce additional information related transaction costs.

Another important approach is the permission of participation of foreign institutions in national S&T programmes, usually without funding up until now. However, some countries already start to open their schemes for R&D activities which are performed abroad. These measures are complemented by less frequently applied ones, like the granting of fiscal incentives or the joint funding of infrastructures.

Beyond doubt, the importance of international S&T collaborations of research organisations has significantly increased. This growing importance is reflected by the high number of countries which have intensified existing schemes and or initiated or plan new initiatives. A trend towards more thematically focussed initiatives, mostly based upon national strengths, which are increasingly differentiated by target countries, can be observed. Small scale initiatives, which by now have usually centred on mobility, are more and more complemented by genuine research promotion activities.

There is seen a need for a systematic, indicator based, continuous monitoring and benchmarking of international cooperation of S&T institutions. Faced with the autonomy of higher education and research organisations and companies, governments might otherwise lose the access to information on bottom-up organised international S&T activities and, as a consequence, might risk losing knowledge based evidence on how to prioritise and structure their complementary or cumulative policy instruments in this field.

Summarising, it should be considered by national policy makers to:

- *o* raise more awareness on the benefits and needs for international cooperation of S&T institutions. This might be supported by tailor-made instruments such as an 'Exhibition of International European RTD Cooperation' or road shows.
- *o* introduce flexible additional funding schemes to balance transaction costs[18] and to avoid additional administrative burden.

18 Contrary to collaboration on local and national level or even collaboration within the EU, where a common market including a – more or less - common regulation scheme exists, R&D collaboration with partners from Third Countries faces a lot of cultural as well as regulatory differences, which cause additional effot and energy. For instance, a considerably higher effort for project management has to be anticipated. In addition, transaction costs occur through additonal search and information costs (e.g. in order to understand for instance different legal and financial regulations

- *o* monitor and benchmark international cooperation of S&T institutions through structured databases based upon revised, sound and standardised indicators, which capture the complete phenomenon of internationalisation of R&D and which enable cross-country comparisons.

It is recommended that policy makers in Member and Associated States:

iii. scale-up available bilateral funding schemes for the internationalisation activities of R&D organisations i.e. through direct funding of collaborative research in addition to small-scale mobility-based networking measures.

4.2 Stimulating international mobility of individual scientists

The stimulation of international in- and outward mobility of individual scientists is one of the classical targets of international S&T cooperation policies. Correspondingly, international mobility is one of the most frequent targets of international cooperation agreements[19]. With the increasing acknowledgement of the crucial role of human resources for successful R&D, innovation as well as technology transfer processes in a knowledge society, the issue of international mobility has received renewed attention also from a more exploitation-oriented perspective and possible shortages of supply of researchers. International mobility of researchers is also one of the cornerstones of the European Research Area[20]. Since 2003, the principles of the Open Method of Coordination (OMC) are applied in the research policy area, with explicit reference to issues of human resources and mobility. The attraction of international researchers to Europe has been one aim of the 3% Action Plan[21].

The importance of mobility-related policies is confirmed by the results of the questionnaire: 19 of 21 responding countries have national policy measures in place to enhance mobility of researchers and S&T students with Third Countries, which are implemented through public funds. In Sweden, there are no national policy measures, but the use of such measures is left to the decision of the agencies and research organisations which are publicly funded. Agencies finance for example post-doc awards to stimulate mobility. In a range of countries, such bottom-up measures exist in addition to specific government funds.

Overview on applied policy measures

As shown in Figure 4.4 most countries target all types of mobility with similar high priority. All 19 countries have measures which aim at increasing the attraction of foreign researchers. Also measures aiming at increasing the international circulation as well as connection of national researchers, increasing the attraction of foreign students and increasing the retention of 'national' researchers working abroad are widespread. The issue of connection and retention of researchers receives the highest priority in average, but the differences in weighting are rather small.

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and requirements of Third Countries), additional bargaining costs (e.g. in order to come to an acceptable agreement which meets the cultural, legal and financial framework of each partner) and additional policing and enforcement costs (e.g. in order to make sure that the other party sticks to its obligations and eventually to take appropriate additional measures which can result in increased communication and travel effort or even in increasing legal costs).

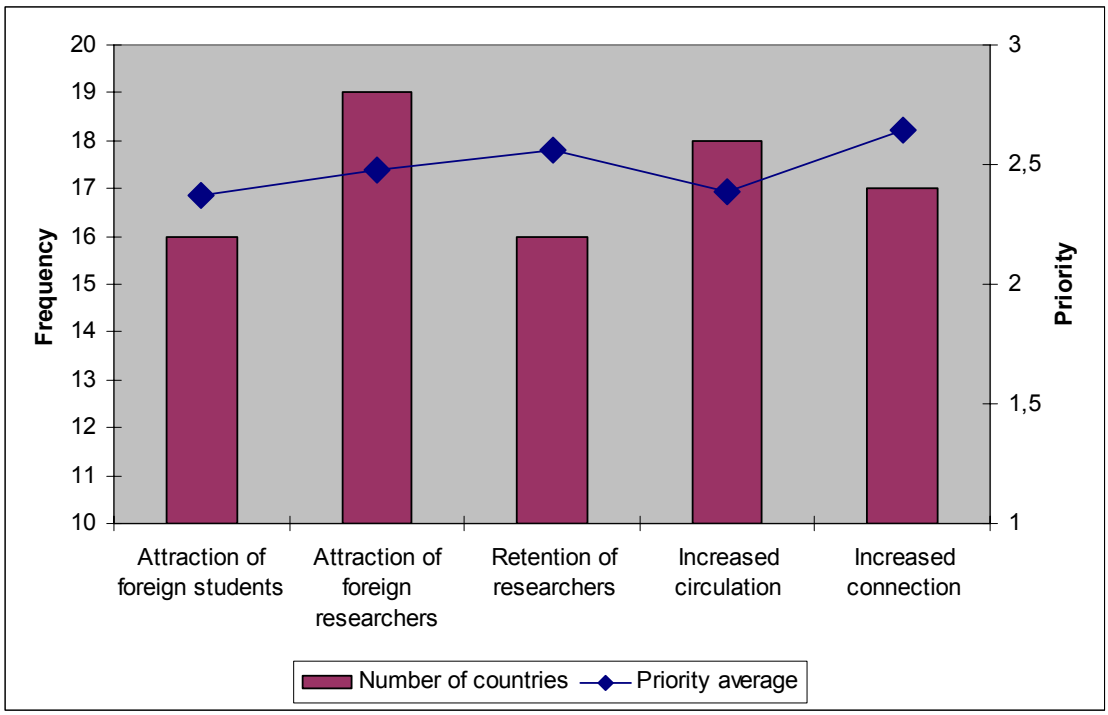
19 See e.g. the INCONET GRICES Survey on International Bilateral S&T Cooperation.

20 See e.g. the Mobility Strategy for the ERA (COM(2001)331 final, 20.6.2001 and Council Resolution of 10 December 2001, OJ C367, 21.12.2001) and the recently published green paper on new perspectives for the ERA (COM(2007)161, 4.4.2007), in which mobility of researchers is one of the six main axes.

21 COM(2003)226 final, 30.4.2003 and Council Resolution of 22 September 2003, OJ C250, 15.10.2003

An analysis of country differences reveals that a high priority for the attraction of foreign researchers goes often hand in hand with a high priority for increased knowledge circulation (seven countries) while the same holds for the combination of a high priority for retention and for the connection of national researchers who work abroad with the domestic system (eight countries). A focus on circulation but not retention as top priority is often found in countries with a rather high R&D performance, such as Finland, Germany, the Netherlands and Austria. The opposite focus is found in some countries with a currently less prominent role of R&D who try to catch-up. Nevertheless, among the latter type a range of countries also prioritise both dimensions equally high. Examples are Greece, Lithuania and Romania.

Figure 4.4: Targeted mobility types



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Practice Example: Implementation of Visa Package, mainly the Directive 2005/71/EC, in the Czech Republic

The responsible authority for the transposition of the Directive is the Ministry of Interior who has to transpose the directive to the Czech legal system by 12 October 2007, and the Ministry of Education, Youth and Sports (MEYS). The process of transposition is being done by the amendment of the Act No. 326/1999 Coll., on the Residence of Aliens in the Territory of the Czech Republic, as amended (Aliens Act). The amendment of this Act was approved by the Government in April 2007 and passed to the Chamber of Deputies of the Parliament, where it is now in the second reading. The responsible Committees recommended it for approval. The cooperating state administration body was the MEYS, who was responsible for transposing the Articles 2, 5 and 6 of the Directive. As it was later on decided that these Articles will be transposed by an amendment of the Act No. 341/2005 Coll., on public research institutions, the responsibility was given over to the Research and Development Council of the Government of the Czech Republic.

Effects of Visa Package:

In line with the main goal of the Directive to simplify and accelerate entry procedures for foreign researchers, the Czech Republic welcomes the speeding up of the whole entry process. It will be much easier to start with the research work without any delay. Consequently this will lead to faster realization of research projects. At the same time, the Third Country researchers will be more motivated by this simplified procedure to come and conduct research in Czech research teams. A very important advantage is the possibility for the family to accompany the researcher. A very useful policy tool will be the electronic register of Third Country researchers for statistical, analytical and reporting purposes. The overall expenses for its creation are expected to be about 0,5 million CZK during the first year, and approximately the same amount in the years fol1owing (technical maintenance of the register and costs for one employee).

Irish Award Schemes to Attract Researchers from Abroad

In ***Ireland***, there are specific funding schemes in place aimed at attracting leading researchers from around the world. The Science Foundation Ireland (SFI) is one of the principal research funders and it operates a broad and flexible suite of awards, all based on international peer review and a number of which are specifically aimed at attracting researchers to come to Ireland and/or set up research teams in Ireland.

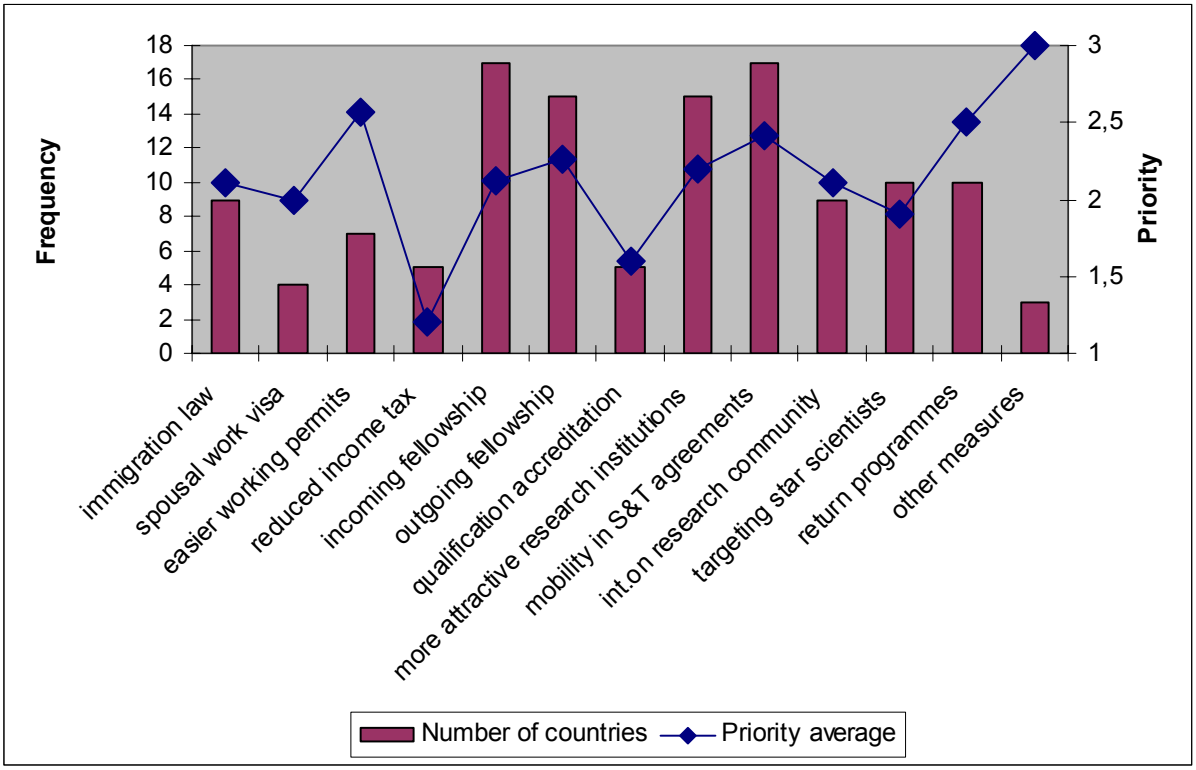
- **Principal Investigator Grants** of up to € 1 million per annum for five years are available and these are aimed at internationally competitive researchers wishing to bring or establish research teams in Ireland;
- **Research Professor Recruitment Awards** aim to attract outstanding researchers with particularly distinguished international reputations with awards of up to € 500,000 per annum for up to two years;
- **ETS Walton Visitor Awards** support leading international scientists who wish to visit Ireland to undertake research for up to 12 months with awards normally ranging up to € 200,000.

SFI awards are part of a broader policy mix which also includes substantial investment in research infrastructure, special arrangements for fast-tracking of work permits and other supports aimed at increasing Ireland's attractiveness to world leading researchers. SFI made its first awards in 2001 and there has already been an initial evaluation of the organisation and its awards (available at www.sfi.ie). A further evaluation, with a stronger focus on impacts, is currently underway.

With regard to applied policy measures to enhance mobility, the pattern is more varied, as shown in Figure 4.5. Four types of measures clearly stand out in terms of frequency:

- enhancement of individual mobility under S&T agreements;
- provision of incoming fellowships;
- provision of outgoing fellowships;
- raising attraction of universities and research institutes.

Figure 4.5: Applied Mobility Policy Measures



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

If member states and associated states are asked for a weighting of priorities using values from 1 (low priority) up to 3 (high priority), the four most frequent measures are still clearly above average, but further measures gain importance, most notably with averages above 2,5, namely

- the provision of return programmes and
- measures to decrease the administrative burden to obtain working permits.

Also other measures are mentioned with high priority. A repeatedly mentioned example are researcher mobility portals.

The frequency and priority attribution (or prioritisation) of measures varies also considerably between countries. In the domain of mobility measures, Ireland, Austria, Germany and the Netherlands stand out in both dimensions.

Table 4.2 below gives an overview of the specific measures applied by different countries.

Table 4.2: Specific measures at MS/AS level to enhance international mobility

Country/ Measure	Immigration law	Spousal work visa	Easier working permits	Reduced income tax	Incoming fellowship	Outgoing fellowship	Qualification accreditation	Attractive research institutions	S&T agreements	Internationalisation of research community	Targeting star scientists	Return programmes	Other measure
DENMARK	x			x	x	x	x	x	x	x	x		
AUSTRIA	x	x	x	x	x	x	x	x	x	x	x	x	
BELGIUM	x				x	x		x	x		x	x	
CYPRUS					x			x	x			x	
CZECH REPUBLIC	x	x	x			x		x	x				
FINLAND					x	x		x	x	x	x		
FRANCE	x	x	x	x	x	x	x	x	x	x	x	x	
GERMANY	x		x		x	x		x	x	x	x		
NETHERLANDS	x	x	x	x	x	x		x	x				X
NORWAY	x				x	x	x	x	x	x			
POLAND					x	x		x	x		x	x	
PORTUGAL	x				x	x		x	x	x			
ROMANIA					x			x	x	x	x	x	
TURKEY					x	x		x	x			x	x
UK	x				x	x		x					
SPAIN				x	x	x			x	x	x		
GREECE					x	x			x			x	
IRELAND	x	x	x		x			x	x	x	x	x	x
LITHUANIA	x		x		x	x	x		x			x	

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a); additional information by MS/AS and European Commission

Practice Example: Setting-up of a Bridgehead Mobility Centre with Era-More in Belgium

The Belgian Research Community has joined forces to further enhance the proximity assistance to researchers from abroad by the creation of the Mercator Network of Mobility Centres. Therefore each university, school for higher education, research organisation or company has identified a Mobility Centre within the organisation or within a group of organisations. The primary task of the Mobility Centres in the Mercator Network is the provision of updated information and personalised assistance to researchers and their families in all matters related to their mobility experiences in Belgium. Every Mobility Centre provides practical information and customised assistance to researchers and their families in all matters relating to their mobility experiences within the relevant organisation.

The Mercator Network is the national implementation of the European Mobility Strategy to create a European Network of Mobility Centres. Belgium has four bridgeheads among one national bridgehead and three regional bridgeheads. The main task of the regional bridgeheads is the organisation and the coordination of the mobility centres within a certain region. The national bridgehead is responsible for the coordination at national level.

Practice Example: Danish Collaboration with Word-leading Researchers in Frontier Research Areas

In the action plan for 2006-2007 the Danish Councils for Independent Research introduced a new type of grant concentrating on professional career shift in the direction of new frontier research areas with help of foreign world-leading researchers. These cross-boundary research stays, e.g. sabbaticals, give a senior researcher the opportunity to 'renew' him or herself scientifically by gathering important knowledge from other research areas or by changing fields entirely, e.g. through research stays at foreign institutions. A significant change in focus area is often related to a high degree of willingness to take risks, which should be seen as a positive trait in the Councils' assessment of activities.

Practice Example: Finland's policy approach to attract best scientists

A small number of foreign students and researchers has been identified as a weakness of Finland's R&D activities. Therefore the attraction of best scientist has been set as a strategic objective.

A new funding programme to recruit foreign top researchers to Finland for a fixed period of time was launched in 2005. The Finland Distinguished Professor Programme (FiDiPro) is run by the Academy of Finland and *Tekes*, Finnish Funding Agency for Technology and Innovation. The goal of the funding programme is to raise the level of scientific and technological knowledge and know-how in Finland, add a more international element to the Finnish research system, generate added value into the national innovation system and support research-driven profiling of universities and research institutes. The programme is also aimed at creating new kind of international cooperation between basic and applied research and the R&D efforts of business companies.

Within the framework of the funding programme, Finnish universities and research institutes can hire foreign researchers or professor-level Finnish researchers who permanently work abroad for 2-5 years to conduct research together with Finnish researchers and research groups. The researchers shall be internationally highly merited and have strong experience of researcher training.

Practice Example: An Interlinked System of Incoming and Outgoing Fellowships in Germany

Building mainly on public funds, the international mobility of individual scientists is supported to a large extent in Germany by intermediaries like the Alexander von Humboldt Foundation (AvH). The AvH offers sponsorship programmes for applicants from abroad (Research fellowships for scientists and scholars) as well as fellowships for applicants in Germany (Feodor Lynen Research Fellowships). Humboldt Research Fellowships are offered for highly qualified, top foreign scientists and scholars of all other nationalities and disciplines holding doctorates, aged up to 40, from abroad. The Fellowship provides for a long-term research stay in Germany (and up to 600 fellowships per annum) are awarded. Fellowships are awarded at a personal level on research quality merit criteria, independent of the candidate's nationality.

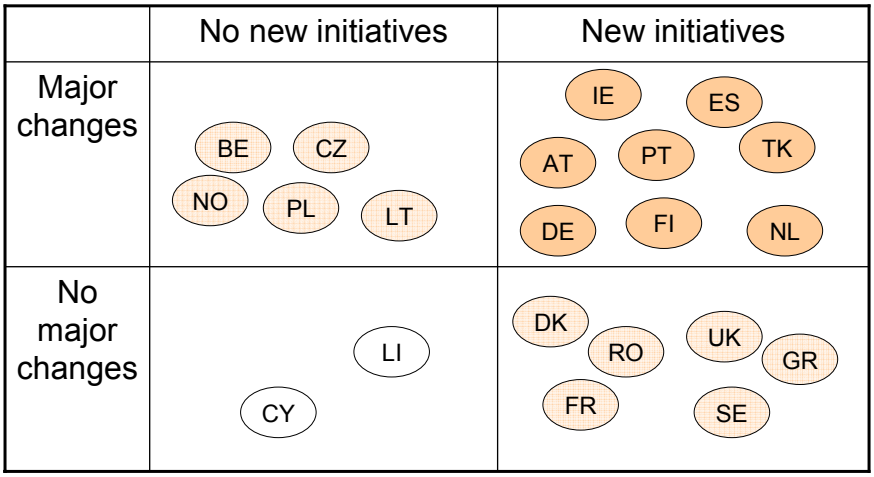
In order to ensure sustainability of personal contacts of these Humboldt fellows with the German hosting institutions much emphasis is given to alumni work. One core element is a specific grant system, which provides funds for follow-up visits to the previous hosting institution in Germany.

In addition, up to 150 Feodor Lynen Research fellowships are awarded annually to highly qualified young German PhDs scholars of less than 39 years of age holding a doctorate. The fellowship enables them to undertake a long-term period of research at the institute of a former AvH-fellow. Besides the two fellowship programmes a variety of research prizes are awarded.

Major changes and new initiatives

A group of 8 very active countries which report both recent major changes and new initiatives comprises Ireland, Austria, Germany, the Netherlands, Spain, Portugal, Turkey and Finland (see Figure 4.6). In total 13 of 21 responding countries report major changes in the domain of enhancing international in- and outward mobility of individual scientists and even two third envisage new initiatives in this domain. The observable dynamics are not surprising, given that mobility measures can also be implemented if available budgets are constrained.

Figure 4.6: Dynamics in collaboration measures



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Conclusions

The promotion and support of mobility of individual scientists is another important activity of S&T policy-making in the field of internationalisation. The rationale behind is based on the insight that knowledge cannot be entirely codified and thus, in principle, accessed each and everywhere. Especially certain scientific approaches, complex understandings and at-the-edge research progresses, but moreover beliefs and values of how research is conducted and how it can generate knowledge in an optimum way are just embodied as tacit knowledge in human beings.

Most MS/AS target all types of mobility with similar and high priority. A focus on brain circulation is often a top priority in countries with a rather high RTD performance, while attraction and retention of researchers is more frequently identified in countries with a less developed RTD system in order to catch-up. From the viewpoint of policy measures, four types stand clearly out in terms of frequency:

- the enhancement of individual mobility under S&T agreements,
- the provision of incoming fellowships

- the provision of outgoing fellowships and
- measures aimed to raise the attraction of domestic universities and research institutes.

Given the prominence of the 'brain drain' argument in current debates, the strong focus on the attraction and retention of researchers is not surprising. The recent literature suggests, however, that this argument should not be overstated, because a brain gain is to a large extent a matter of brain circulation and a certain brain loss is a price worth paying for the benefits arising from increased international mobility[22]. In this perspective, our observation that all types of mobility are being targeted (see Figure 4.5 above) is encouraging for the future of international S&T cooperation.

The majority of MS/AS plan new initiatives in the field of mobility support for researchers. The observable dynamics are not surprising, given that mobility measures can also be implemented without high investments. Many of those new initiatives focus on mobility measures towards Third Countries, because intra-European mobility is to a certain extent already covered under the European Framework Programme for RTD. Nevertheless, most notably about half of the indicated recent major changes in mobility-oriented national policy measures relate to EU initiatives, namely:

- the creation of national researcher's mobility portals under the European Researcher's Mobility Portal, a joint initiative of the European Commission and the 34 countries participating in the European Union's 7th Framework Programme;
- the set-up of national mobility centres to offer customised assistance under the European Network of Mobility Centres (ERA-MORE) initiative (see the Belgian example);
- the implementation of the EU Directive 2005/71/EC ('visa package') aiming at easier access of Third Country researchers (see the Czech example).

Repeatedly, those measures are also mentioned as example for successful measures, either due to the demand encountered or due to the incentive for further action generated.

Summarising, it should be considered by national policy makers to:

- put more emphasis on 'brain connection' with domestic researchers who work abroad in order not to loose the liaison with the national system of research and strengthening the domestic absorption capacity[23].
- provide mechanisms for research organisations from different MS/AS to join forces in order to organise collectively mobility measures with partners from Third Countries. In such networks, Third Country researchers should have the possibility to move freely within the network and to the benefit for all the network members. Closer geographical proximity among the European research organisations could be a driver for the success of such a new approach.
- put more focus on mobility of experienced researchers at the height of their productivity, as well as supporting women researchers mobility.
- promote specific support schemes for female researchers which take specific aspects of work-life-balance into consideration.

22 For a recent overview of the literature see e.g. Moguerou, Philippe (2006): The Brain Drain of Ph.D.s from Europe to the United States. What we Know and What We Would Like to Know. EUI Working Paper RSCAS No. 2006/11.

23 One example at the European level is the ERA-Link initiative (http://cordis.europa.eu/eralink). ERA-Link is a networking tool for European researchers in the US. It provides information about research in Europe, European research policy, opportunities for research funding, for international collaboration and for trans-national mobility.

- o enhance Alumni systems, which might be supported through funds for follow-up visits of foreign researchers to their previous hosting institution in Europe.

It is recommended that policy makers in Member and Associated States:

iv. develop more advanced instruments to foster a balanced brain circulation (considering multilateral schemes).

4.3 Attracting and making use of foreign direct investments

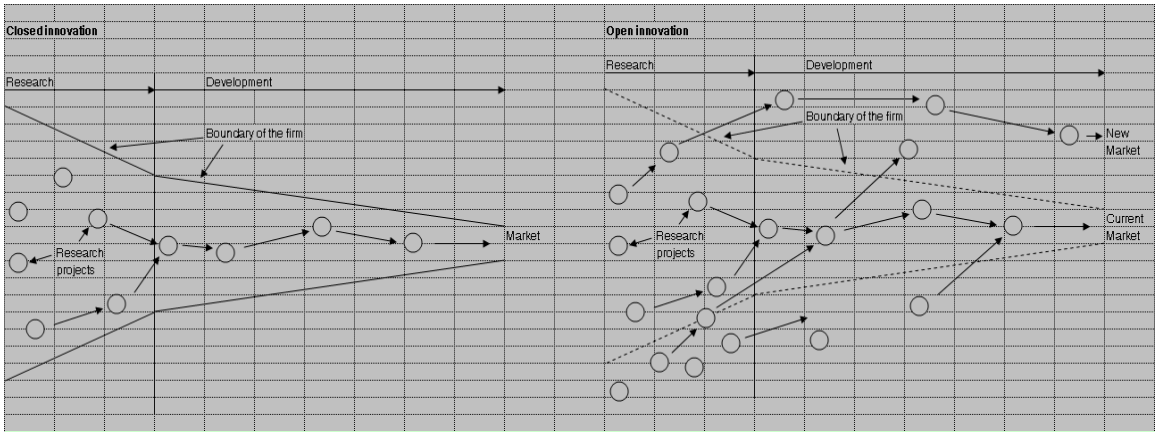
Because of its complex and tacit nature, R&D has for long times been one of the least mobile activities of Multinational Enterprises (MNE). The technological capabilities of firms were far less globalised than their other activities, such as marketing and investment in production facilities. Firms by large performed R&D and undertook patenting at their home country for three main reasons. The first was the tacit, person-embodied non-transferable character of much technological knowledge, which led to locational 'stickiness'. Secondly, firms (including MNEs) are strongly shaped by their home country's specialisations and national innovation systems (including, e.g., accumulated research skills and labour force skills).[24] Thirdly, also issues of security and protection played a certain rule. With increasing global governance effort towards IPR this risk gradually diminishes.

However, current evidence on flows of R&D suggests that the global business environment has changed. Due to intensified global competition, companies have been forced to innovate more quickly and develop commercially viable products and services more rapidly. Relevant knowledge has become increasingly multidisciplinary and global in scope, making innovation both more expensive and riskier. At the same time, some barriers to the dispersion of R&D have become less significant owing to rapid developments in information and communication technology and international regulation attempts. These trends imply changes in the governance of innovation in MNEs, with important implications for the role of subsidiaries in recognising and exploiting the potential for innovation. This resulted in more global distributed R&D networks[25], and MNEs increasingly becoming integrators of globally distributed R&D forcing them to manage their global innovation networks resourcefully with a right balance between local in-house R&D, external R&D, and R&D performed at foreign affiliates or by foreign partners.[26] As a result both inward and outward foreign direct investment in R&D became increasingly important. These changes are closely related to the paradigm of open innovation[27].

The open innovation model is a dynamic (and less linear) approach where companies look inside-out and outside-in. Increased R&D cooperation and higher reliance on external sources have become important ways of knowledge sourcing in order to generate new ideas and bring them quickly to the market. At the same time companies commercialise both their own ideas as well as innovations from other entities, in which academic research occupies a major place. Companies may also spinout technologies and intellectual property that were internally developed but are determined to be outside the core business and better developed and commercialised by others. Multinationals heavily link up to start-up-firms, spin-offs and the public R&D system through their permeable boundaries. Companies' solid boundaries are transformed into a semi-permeable membrane that enables innovation to move more easily between the external environment and the companies internal innovation process (Figure 4.7).

24 Pavitt and Patel, 1999.
25 OECD, 2006a
26 Karlsson, 2006.
27 Chesbrough, 2003.

Figure 4.7: Open innovation



Source: Chesbrough, 2003

EU based companies fully participate in the process of internationalisation of R&D and see arising opportunities in newly emerging economies (especially China and India). However, signs appear on a decreasing interest of inward FDI in Europe (especially by US based firms – EU's share declined from about 70% at the beginning of the nineties to about 60% in more recent years[28]). As such, and especially with regard to the 3% objective, it is not surprising that this topic gained increasing attention over the last years and many MS/AS put in place or envisage specific strategies to attract and/or make better profit from FDI in R&D.

Table 4.3 shows the R&D expenditure of foreign affiliates in % of R&D expenditures of enterprises of selected European countries based upon OECD data. There are strong differences both in terms of foreign share and dynamics, which depend mainly on the openness of the economy. The effect of increasing internationalisation is expressed by a trend towards an increased share of R&D expenditures of foreign affiliates. Only Italy and Spain show a slightly different picture.

Table 4.3: R&D expenditure of foreign affiliates as a % of R&D expenditures of enterprises

	1999	2004		1999	2004
Belgium		55,6	The Nether-lands	21,5	31,3°°
Czech Republic	27,4	48,7	Poland	12,1***	16,8
Finland	14,9	16,4	Portugal	18,0	24,6°
France	16,4*	25,3	Slovak Republic	20,4***	20,4
Germany	17,8	26,7°	Spain	32,8	27,0
Greece	4,5		Sweden	36,4	45,3°
Hungary	78,5*		Turkey	7,3	6,7°°
Ireland	63,8	72,1°	United Kingdom	31,2	38,6
Italy	33,0**	32,1°			

*1998; **2001; ***2000; °°2002; °2003

Source: OECD, Main Science and Technology Indicators, December 2006

28 NSF, 2006.

Overview on applied policy measures

Policy attitudes towards inward FDI in R&D[29]

It is a common practice among MS/AS to pursue specific measures supporting the establishment of new R&D activities from Third Countries in the own country. Only Cyprus, Liechtenstein, Denmark and Lithuania form an exception to this.

In general, no discrimination (positive or negative) is in place for R&D performed by affiliates owned by Third Countries vis-à-vis domestic R&D active institutions. For Romania, no discrimination exists based on fiscal or R&D programmes. However, differences exist in terms of administrative support and openness towards public-private partnerships and projects, providing the strict application of state aid regulations regime.

Before dealing in more detail with policies and instruments towards FDI in R&D, it should be noted that in many countries policies towards the attraction of FDI in R&D are included in more general policies towards the attraction of FDI in general.

Instruments to attract R&D capabilities from abroad

The success of attracting foreign R&D depends both on the internal strategies of MNEs, and on location characteristics such as adequate infrastructure, public research facilities, educational system and science base of location.[30] There is a recent trend towards boosting business R&D and innovation through a variety of targeted policy instruments in order to enhance the national capacity of attraction. For this, a trend has been identified towards higher attention of indirect mechanisms.[31]

Looking at Figure 4.8, in over half of the 17 countries pursuing an active policy towards inward FDI in R&D, one or a mixture of the following policy measures are applied: promotion of national strengths abroad; cluster policies towards the attraction of FDI in R&D; administrative support; provision of infrastructure; active recruitment, direct financial support and fiscal incentives. Less frequently used measures include the provision of subsidised space in S&T parks (often aimed at bringing together public and private actors) and public procurement. In most MS/AS, these measures are done as a package to create positive environment and it is difficult to separate the effect of one over another. In contrast with the main motives for R&D location (market perspectives, technology perspectives and availability of researchers[32]) policy makers perceive actions in the field of fiscal incentives as most prior (effective). A differentiation of applied measures by countries is shown in Tab. 4.4.

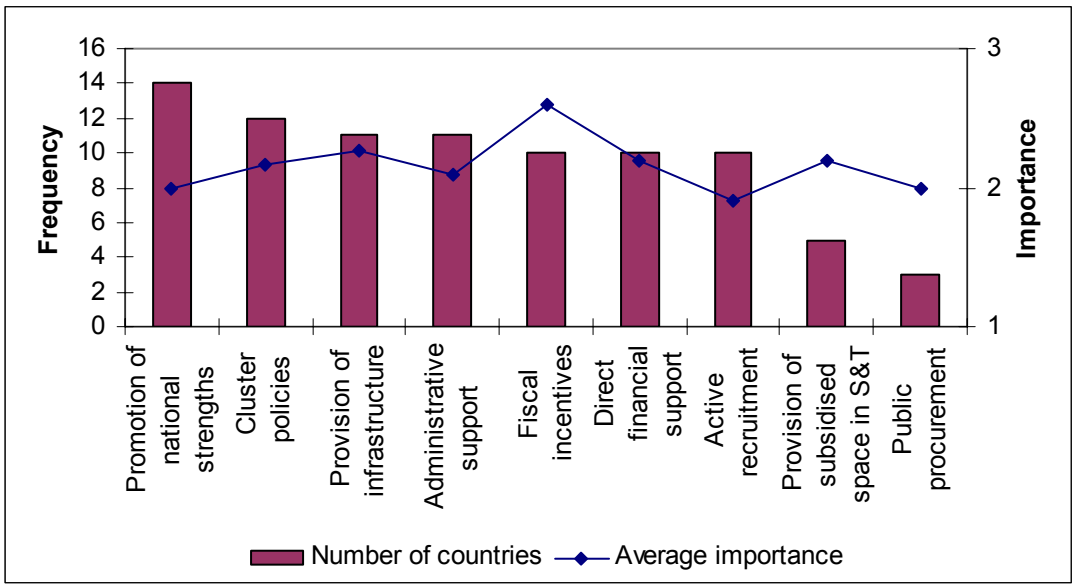
29 The information here presented takes on board information for Liechtenstein, Romania, Austria, Germany, Finland, The Netherlands, Poland, Turkey, France, Czech Republic, Norway, Sweden, UK, Belgium, Portugal, Denmark, Cyprus, Lithuania, Ireland, Greece and Spain.

30 Molero and Alvarez, 2004.

31 OECD, 2004 and Dachs et al., 2005.

32 UNCTAD, 2005.

Figure 4.8: Applied policy measures and their importance for the attraction of inward FDI in R&D



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Table 4.4: Specific measures at MS/AS level to support the location of new R&D activities through inward FDI

	Direct financial support	Fiscal incen-tives	Admin. support	Provision of infra-structure	Provision of subsi-dised space in S&T parks	Public procure-ment	Active recruit-ment	Promotion of national strengths abroad	Cluster policies
Austria	x		x	x			x	x	
Belgium	x	x	x	x	x		x	x	x
Czech Republic	x	x	x	x			x	x	x
Finland	x						x	x	x
France	x	x	x	x	x	x	x	x	x
Germany							x	x	
Greece	x	x			x			x	
Ireland	x	x	x	x			x	x	x
The Nether-lands		x	x	x		x	x	x	x
Norway			x	x			x	x	x
Poland								x	
Portugal	x	x	x	x					x
Romania	x	x	x	x	x	x	x		x
Spain	x	x	x	x	x			x	x
Sweden								x	
Turkey		x		x					x
United Kingdom	x		x					x	x

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Practice Example: The Czech approach to attract FDI in R&D

Cluster policies exist towards the attraction of FDI in R&D showing the ability of Czech research bodies to establish through cooperation successful clusters, e.g. the International Clinical Research Centre in Brno. This is completed by direct financial support and investment support in the area of Technology Centres and Centres of Strategic Services. It is governed by the Framework Programme of the Ministry of Industry and Trade and managed by CzechInvest (Investment and Business Development Agency). Maximum state aid is 40%. Since the year 2000, 65 new technology centres of domestic and foreign companies were established in the CZ with help of CzechInvest, creating more than 4000 working places in industrial R&D and product design. In addition, administrative support is delivered and the Programme One-stop-shop - developed by South Bohemian Region in cooperation with Regional Development Agency of South Moravia - aims at optimisation of regional offers/bids and increased effectiveness in negotiations with foreign investors.

Policy instruments to profit from spillovers from FDI in R&D (both inward and outward)

Although most countries put in place instruments to attract FDI in R&D, only a limited number of countries rely on specific policy instruments to profit from spillovers from FDI in R&D.

The 'Investment Law' in **Greece** supports the realization of a complete long term (2-5 years) investment plan by enterprises (which have been incorporated for at least five years) relating to processing and mining projects of a minimum total cost of € 3.000.000 and projects for software development of a minimum total cost of € 1.500.000, including the technological, administrative, organisational and business modernization and development as well as the necessary deeds for the training of the employees, having (as one of the) objective(s) the relocation of production / research activities to from abroad Greece. The amount of the grant depends on the firm size, the geographical zone the investments is located in, and are divided in two categories of business activities.

In **Ireland**, various initiatives are in place regarding the embedding of inward FDI in R&D. Science Foundation Ireland has developed CSETs (Centres for Science, Engineering and Technology) which act as a key instrument in encouraging interaction between the foreign MNE bases in Ireland, indigenous enterprises and the third level sector. MNEs were not attracted to sectors in which the country was traditionally advantaged, but to high tech industries, so that FDI had a tangible impact in Irish industry as it motivated a structural shift in sectoral and regional terms. As a result, in the last decade the country showed significant growth in FDI inflows where the greatest part is accounted for by Greenfield investment or expansions, as opposed to mergers and acquisitions.

Romania gives a strong support to larger scale projects in the field of R&D and innovation, which are initiated by strategic foreign investors and developed either within national R&D and innovation programmes or on the basis of public-private partnership. The projects are treated in full accordance with the provisions of the new EU State Aid Framework for R&D and innovation.

Turkey makes efforts to integrate FDI in R&D in the national innovation system by stimulating the location of FDI in techno parks. Attention is paid to integrate inward FDI in R&D in the more general policies of establishment of technoparks and policies towards reinforcing the cooperation by industry and universities and the set-up of Technology Platforms in several sectors. Innovation performance of the business enterprise sector has been a substantive

theme of the 14th and 15th meetings of the Supreme Council for Science and Technology (SCST). With reference to the SCST decrees on the preparation and approval of National Innovation Strategy, an initiative has been launched by TÜBİTAK to trigger the establishment of Technology Platforms (TPs). TÜBİTAK facilitated the establishment of TPs in five sectors, namely, electronics, textile, automobile, metal, and marine. On the other hand, TUBITAK encouraged other sectors to establish national TPs as a self-initiative and launched a new support programme for networking and platform activities to assure the sustainability of these platforms. As a mechanism TPs operate for R&D and innovation based competitiveness based on self-governance and cooperation. TPs are expected to prepare strategic research agendas for their sectors and assure implementation of these agendas. Furthermore, TPs are expected to help identifying and removing the barriers in private enterprise sectors' innovation performance.

Major changes and new initiatives

Policies towards FDI in R&D increasingly received attention by policy makers over the last years. By consequence, a large number of countries recently revised its policies and/or envisages new initiatives (see Table 4.5).

Table 4.5: Major changes and new initiatives in policy measures towards FDI in R&D

	No new initiatives	New initiatives
Recent major changes	Finland France	Austria Czech Republic Germany Greece Ireland The Netherlands Romania Spain Turkey UK
No recent major changes	Belgium Cyprus Liechtenstein Portugal Lithuania Poland	Norway Sweden

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Examples of major changes and new initiatives include:

- ***Austria***: the adoption of an R&D Headquarters Programme by the Austrian Research Promotion Agency and the opening of a China-Austria Technology Park in Vienna;
- ***Czech Republic***: approval in 2003 by the Government of a Framework Programme for the support of Technology Centres and Centres of Strategic Services of the Ministry of Industry and Trade, managed by CzechInvest (Investment and Business Development Agency). Also a new version of the Framework Programme for the support of Tech-

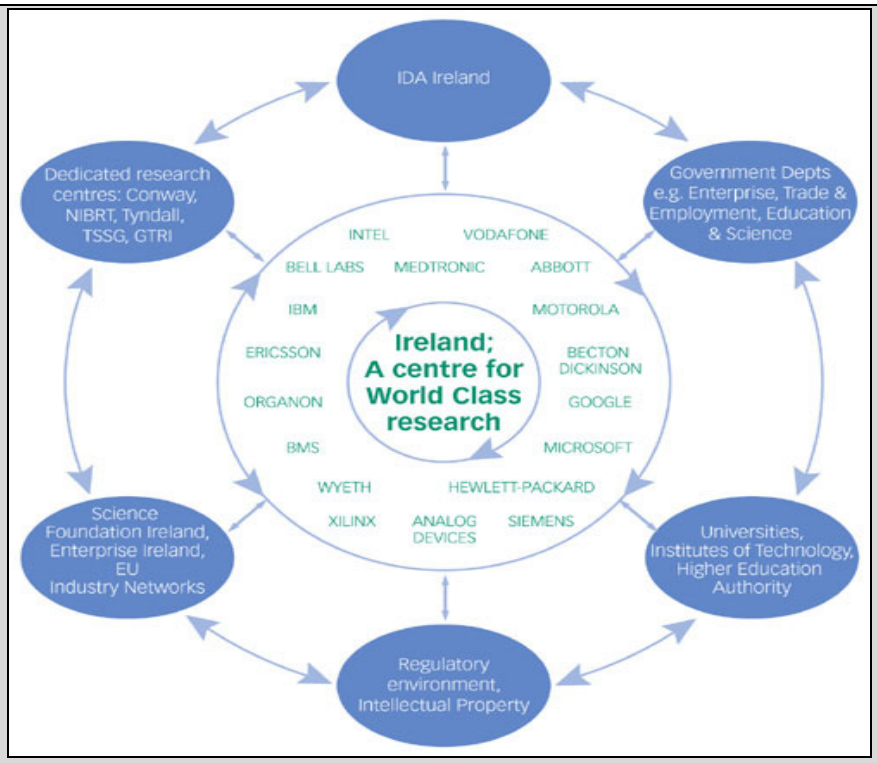
nology Centres and Centres of Strategic Services of the Ministry of Industry and Trade is under preparation;

- ***Finland***: active promotion of FDI in R&D has been used as a policy instrument only very recently;
- ***Germany***: in 2002 the initiative 'Invest in Germany' was launched with one of its objective to attract S&T investments. In 2005 the initiative on research marketing of the Federal Ministry of Education and Research (BMBF) was additionally introduced. Furthermore, an 'Excellence Cluster Competition' for stimulation of regional innovation processes building on internationalisation of S&T activities was launched to attract foreign knowledge through S&T cooperation, individual high-qualified scientists, capital and investments etc. In addition to 'Invest in Germany' several federal agencies and regional development agencies are also authorised to attract foreign direct investments.
- ***The Netherlands***: with a proactive strategic approach the Government together with regional development agencies and key technology clusters in the Netherlands focuses on the acquisition of R&D, innovative, high tech, and other knowledge intensive investments. All policy documents state that it is impossible for the Netherlands to excel in all fields. With limited resources and increasing competition, it is essential to invest in those areas of innovation that provide the best opportunities for strengthening the country's competitiveness and generating the greatest social benefits. Therefore in the key areas acquisition goals are set and 'value propositions' are prepared, based on the ambitions and development goals in these key areas. The acquisition goals will be explored proactively in relevant international markets.
- ***Norway***: an 'Invent in Norway scheme' is currently considered. The main aim would be to stimulate foreign investments in R&D in Norway and the location of R&D activities in the country.
- ***UK***: UK Trade & Investment (UKTI) is the Government organisation that helps UK-based companies succeed in an increasingly global economy. Its range of expert services is tailored to the needs of individual businesses to maximise their international success. The UKTI five year strategy 'Prosperity in a Changing World' was published in 2006. During the implementation of the strategy marketing material on R&D in the UK were developed. A world-class proposition was published in February 2007.[33]

Practice Example: Attracting FDI to R&D

Ireland's approach to the attraction of R&D-intensive FDI projects is built on a strategy developed over many years for attracting FDI projects generally. Ireland's FDI effort is led by its Investment Promotion Agency (IDA Ireland) which places a strong emphasis on bringing together all of the other actors (government departments, funding agencies, regulatory authorities, academia and existing enterprises) to ensure that all parties play their part in creating the type of environment demanded by world-leading research-intensive global enterprises.

33 https://www.uktradeinvest.gov.uk/ukti/fileDownload/UKTIStrategyJuly2006.pdf?cid=391741



IDA Ireland leads the effort to attract R&D-intensive projects based on the sectoral expertise it has developed over many years in areas such as ICT hardware and software, medical devices, pharmaceuticals, financial and other international service activities. A combination of direct financial supports and/or fiscal incentives is available to encourage the establishment of new R&D projects in Ireland and to encourage existing MNEs to increase their research capacity in Ireland. These incentives are part of a broader mix that also involves:

a) Supply of skilled researchers (to doctoral and post-doctoral level) in disciplines of relevance to existing and emerging FDI clusters in Ireland;

b) A growing network of public and private applied research centres which act as a magnet for the attraction of R&D-intensive FDI projects;

c) Investments in people and facilities by Science Foundation Ireland including partnerships with a number of large multinational enterprises in a number of CSETs (Centres for Science, Engineering and Technology). CSETs seek to align the interests of researchers and enterprises in a small number of niche areas and can receive up to € 5 million per annum of public funding for up to 10 years. The following CSETs have been set up in recent years, each one associated with a number of large enterprise partners (many of which represent significant FDI in R&D):

- Alimentary Pharmabiotic Centre
- Digital Enterprise Research Institute
- Centre for Research on Adaptive Nanostructures & Nanodevices
- Regenerative Medicine Institute
- Centre for Telecommunications
- Value-Chain-Driven Research
- Software Engineering Research Centre
- Biomedical Diagnostic Institute.

The **Romanian** government put in place specific measures supporting the establishment of new R&D activities from Third Countries and develops an active policy to attract foreign direct investment. Within the new National Plan for R&D and Innovation for 2007-2013 (through the innovation specific programme) it gives strong support for R&D projects initiated by industry (according to state aid rules for R&D).

The governmental authority responsible for policies addressing FDIs is the Romanian Agency for Foreign Investments (ARIS / www.arisinvest.ro). The policy to attract and promote FDIs gives highest priority to projects exceeding the equivalent of USD 1 million, which are expected to have significant impact on the Romanian economy. In 2006, FDIs reached approx. € 9,1 billion, registering a 74,2% increase as compared to 2005, when they reached € 5,2 billion.

The programme 'Innovation' within the new National Plan for R&D and Innovation for 2007-2013 takes into account the importance of finalising research activities by practical results, related to technical and technological developments. The main component of the programme supports pre-competitive and competitive research projects initiated by industry, oriented towards the development of new / improved products, technologies and services, which are going to be effectively introduced into production circuits.

The budget allocated to the Innovation Programme for the whole period 2007-2013 is of 2,025 billion lei (approx. € 630 million), representing around 14% of the total budget of the Plan, which is 15,00 billion lei (approx. € 4,5 billion).

Beside the ICT industry, FDIs with strong, consolidated production lines (as those of the steel and car industries, oil industry, pharmaceuticals, cement or wood industry) are the ones expected to be important participants in the programme, especially for R&D projects aiming to develop and/or apply technologies for sustainable processes (reduced or non-conventional energy consumption, environment-friendliness).

The programme also includes modules dedicated to the development of the innovation infrastructure (projects for technology transfer centres, incubators, S&T parks) and of the quality infrastructure. S&T parks located around technical universities in major cities (Bucharest, Timisoara, Cluj, Iasi etc.) are privileged locations for R&D-oriented centres developed by FDIs.

It is still too early to evaluate the real impact of the whole package of fiscal incentives for RDI activities. The 100% deductibility (of taxable income) for current R&D expenditures was only introduced in the Fiscal Code (Law 571/ 2003) starting with 2007 (the Code was revised in 2006).

The other incentives were introduced in 2003. Thus, since then, the FDIs could largely benefit of provisions such as:

i) the deductibility of:

- 20% of the value of investments with significant impact in economy;
- expenditures for introduction of IT and of quality systems, for conformity evaluation, for environment and resources protection

ii) flexible options for the depreciation of expenses for the acquisition of corporal and non-corporal assets:

- technological equipment, respectively for machines, tools and installations, and also for computers and peripherals;

• patents, licenses, author rights, trade marks and other similar values.

Yet, the impact of these categories of incentives seemed to have remained low during 2003-2005, when, according to the statistical data, the R&D expenditures of enterprises did not pass over a steady low level of around 0,2% of GDP.

Conclusions

FDI in R&D is high on the political agenda of most MS/AS. Most of these countries have recently put in place or revised their policies with the aim to increase their country's attractiveness for inward FDI and a wide range of policy instruments is used to do so. The most frequently applied policy measures include the promotion of locational strengths abroad and active recruitment, cluster policies towards the attraction of FDI in R&D, administrative support for foreign investors, provision of infrastructure, direct financial support and fiscal incentives. Since these measures are usually implemented in a package, their effects are difficult to separate. In contrast with some main motives for R&D (re)location (such as market perspectives, technology perspectives and availability of researchers), policy makers perceive actions in the field of fiscal incentives as most prior.

- The findings of the questionnaire revealed that fewer countries take into account that foreign direct investment in R&D is not an a priori condition for economic success. Those who did so, pay more attention to the enhancement of the possible positive outcomes of these investments. The potential direct benefits of R&D related FDI for host countries depend on whether or not knowledge and skills can be isolated from their surrounding host environment in the long term. In case that MNEs create high-technology enclaves with little diffusion of knowledge into the economy, the benefits for the host country will be limited. The fragmentation of R&D and the increasing specialisation of individual units can make the scope for transferring broad knowledge narrower, reinforcing the enclave nature of R&D units. Moreover, FDI into R&D may also divert scarce local R&D resources from local firms and research institutions.[34]

Table 4.6 Benefits and drawbacks of foreign direct investment in R&D

	On host country	**On home country**
Positive impact	• Increased local technical capability • Potential knowledge & economic spillovers • Job creation • Better tailored products	• Tap into other sources of expertise • Enhance access to foreign makers • Economic benefits if the results are exploited at home
Negative impact	• Foreign control over domestic R&D resources • Loss of economic benefit if the results are exploited elsewhere	• Loss of jobs • Loss of technical capability • Loss of economic benefits if results are exploited locally

Source: Sheehan (2004)

34 UNCTAD, 2005.

Summarising, it should be considered by national policy makers to:

- to set up adequate measures to exploit more intensively the potential of FDI in R&D in order to profit from *inward* FDI in R&D by generating spillovers into the local environment and by avoiding hollowing out the local research base.
- pay more attention to the role of outward FDI in R&D by stimulating and capturing spillovers of foreign generated knowledge to domestic R&D environments, both by public and private research institutions.
- targeting national policy measures more on comparative knowledge advantages rather than on cost competition, in order to ensure a better sustainability
- develop measures to the benefit for the entire EU rather than to focus to narrowly on locational competition measures between MS/AS

It is recommended that policy makers in Member and Associated States:

v. improve instruments which allow national S&T institutions and innovative firms to raise the full potential of spillover effects from inward and outward FDI.

4.4 Setting the frame for the international exploitation of knowledge

In the process of internationalisation of research, the nature of research itself and the way it is performed is changing as well. Future technology trends will be marked by more trans-disciplinarity and trans-institutional cooperation will gain importance. These phenomena are closely related to a tendency for higher reliance on external sources and networking as well as to the new paradigm of 'open innovation'. Also notice can be made of a growing tendency towards the de-linking of the place where the commercial exploitation of the outcomes of R&D takes place with the place where the R&D is performed. These phenomena enhance policy makers to (consider to) intervene in the process of the internationalisation of the exploitation of the knowledge results stemming from research.

This topic is closely related to the protection of intellectual property, and includes activities like technology licensing, reverse engineering, the transfer of knowledge associated with foreign manufacturing of innovative products, trade in high-tech products, the technology balance of payment and international cooperation in terms of patenting and publishing.

This section investigates to what extent governments from the MS/AS actively support the international transfer and the utilisation abroad of intellectual property and other S&T outcomes. It includes both policies towards the international dissemination of knowledge generated by S&T institutions in the home country and policies to exploit at the national base the results of research generated abroad.

Overview on applied policy measures

MS/AS governments' attitudes towards the international exploitation of research

In general, three types of governmental attitude towards the international exploitation of research can be identified. A first important group of countries are in favour of an open international dissemination of knowledge. In a second group, the largest one, MS/AS are found to have a balanced view, i.e. they search for an intermediate way between completely open dissemination and a strict protection of knowledge. No country turns out to

be strictly protectionist but a handful of countries have no clear opinion on how policy looks at this topic.

Table 4.7: Governments' attitudes towards the international exploitation of research

OPEN	BALANCED	CLOSED	NO CLEAR OPINION
Denmark	Belgium	-	Austria
Liechtenstein	Czech Republic		Cyprus
Norway	Finland		Greece
Portugal	France		Lithuania
Romania	Germany		Spain
UK	Ireland		
	The Netherlands		
	Sweden		
	Turkey		

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Among the states with a balanced policy different approaches are in place. For example, in Germany, protection is true in particular for high competitive S&T domains (i.e. innovative technologies). On the other hand, there are national programmes, which explicitly aim at the international utilisation of German know-how through German industries in co-operation with foreign partners (e.g. in the field of water technology). In the Czech Republic policy depends on S&T agreements and on case by case solutions. France puts in place agreements for sharing intellectual property and valorisation with foreign countries and Sweden – for instance - highlights the need for agreements to be set up between the partners.

Policy measures to enhance the exploitation of domestically produced knowledge in Third Countries

Table 4.8 shows that countries with a balanced approach towards the dissemination of knowledge usually put in place policy measures to regulate the exploitation of domestically produced knowledge in Third Countries. Not surprisingly this is far less the case for countries with an open view in this respect. However, as the example of Norway reveals, an open view and no regulation are not necessarily synonymous. In Norway IPR measures are intended more to regulate the knowledge which comes out of the cooperation that takes place on the basis of bilateral agreements rather than to protect pre-existing 'national knowledge'. On the other hand, the Swedish and Dutch position combining a balanced view with no regulation invites for further explanation. In the Swedish case all university scientists own their ideas and patents. It is therefore, in general, not a matter for the government to regulate the exploitation of knowledge (private property) by individual scientists. However, most R&D agreements have clauses on how IPR should be dealt with. In such cases it is up to the individual scientist to decide to work under an agreement with partners in collaboration on how possible IPR coming out of research will be dealt with.

Table 4.8: Governments' attitudes towards regulating of the exploitation of domestic knowledge in Third Countries

	Balanced	Open
No regulation	The Netherlands Sweden	Denmark Liechtenstein Portugal Romania UK
Regulation	Belgium Czech Republic Finland France Germany Ireland Turkey	Norway

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

The Netherlands do not have any specific rules concerning the exploitation of knowledge that has been developed within the country. In general, universities are free to develop their own rules and conditions within legal boundaries.

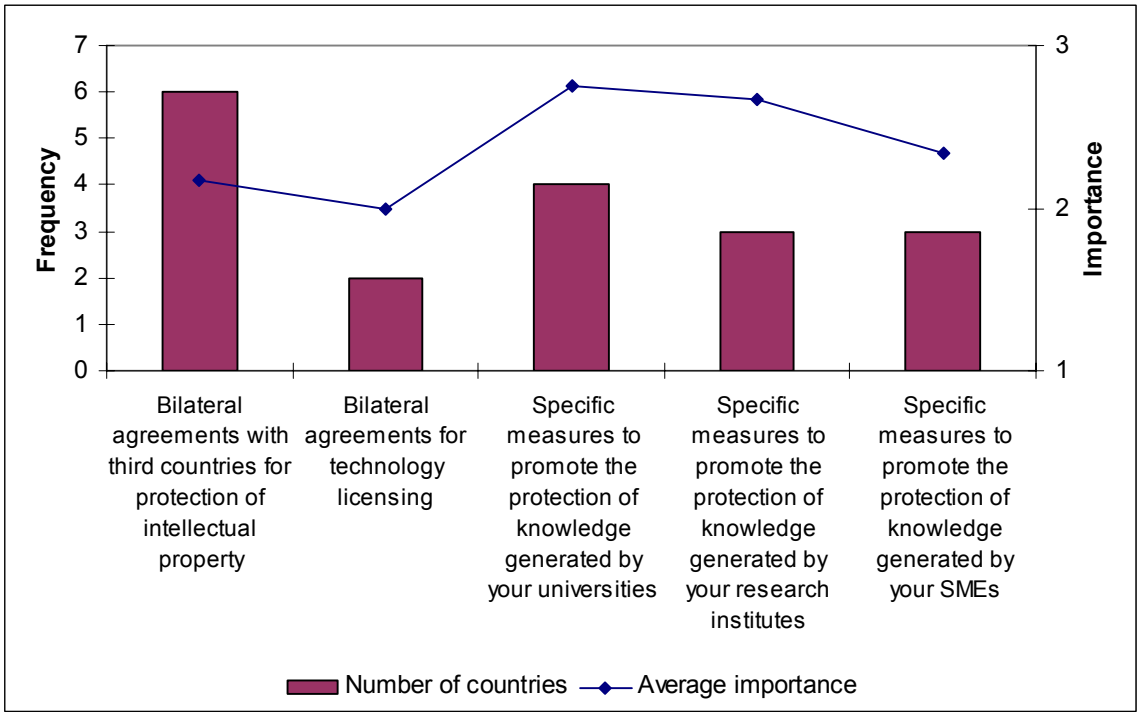
Figure 4.8 summarises the policy measures applied and their perceived importance to regulate the domestic exploitation of knowledge in Third Countries. Most often used measures to regulate the exploitation of knowledge in Third Countries include bilateral agreements with Third Countries for the protection of intellectual property and specific measures to promote the protection of knowledge generated by universities, research institutes and SMEs (Figure 4.9.). From a policy perspective highest priority is given to the protection of knowledge generated by universities and research institutes. Table 4.9 gives an overview on different policy measures applied differentiated by selected countries.

Table 4.9: Policy measures to regulate the exploitation of domestically produced knowledge in Third Countries – overview at the level of some MS/AS

	Bilateral agreements with Third Countries for protection of IP	Bilateral agreements for technology licensing	Specific measures to promote protection of knowledge generated by:		
			'your' universities	'your research institutes'	'your SMEs'
Belgium	x				x
Czech Republic	x				
Finland	x				
France	x	x	x	x	x
Germany	x		x		
Ireland			x	x	x
Norway	x	x	x		
Turkey				x	

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Figure 4.9: Policy measures (and their perceived importance) to regulate the exploitation of domestically produced knowledge in Third Countries



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Practice Example: Exploitation of research performed in Ireland

In terms of the exploitation and commercialisation of research performed in Ireland, there is a strong emphasis on capturing the economic benefits of (publicly-funded) research within the island. New and strengthened mechanisms are being put in place to encourage the transfer and exploitation of such research by enterprises based in Ireland (indigenous and foreign-owned). At the same time, there are no specific barriers placed on the exploitation of research outside Ireland and there is recognition that many opportunities can be best exploited/taken-up by enterprises outside the country.

Policy measures to enhance the national exploitation of knowledge produced in Third Countries

Besides the protection of own knowledge and taking into account the ideas of open innovation, governments could consider to stimulate the exploitation of the outcomes of research produced in Third Countries on the national territory. In the following 16 countries no policy measures exist to enhance the national exploitation of knowledge produced in Third Countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, France, Germany, Liechtenstein, Lithuania, the Netherlands, Poland, Portugal, Spain, Sweden, Turkey, and the United Kingdom. Only five countries mentioned to actively promote the domestic exploitation of knowledge produced abroad: Finland, Norway, Romania, Ireland, and Greece. For Romania this is highly related to an active policy to attract strategic foreign direct investment (see section 4.3).

Practice Examples: Exploitation of research performed abroad

In ***Finland***, national R&D funding is available to license technologies from abroad. Purchasing IPRs from abroad is one category among R&D internationalisation measures in *Tekes* project funding. The expense from the purchase can be included in costs that are eligible to be financed. This policy is based on a general societal interest to advance technology transfer.

In ***Greece***, the so-called PRAXE-Funding mechanism for the exploitation of knowledge is in place independent from the place where this knowledge is produced. The 'PRAXE' Programme is an initiative under the Operational Programme 'Competitiveness' of the Greek Ministry of Development in the context of the Community Support Framework III for the period 2000 - 2006. The programme was managed by the General Secretariat of Research and Development. The objective of Phase A, which can be viewed as a 'seed' financial instrument, was to support researchers and research institutions to identify and commercially exploit R&D results, through knowledge intensive spin-offs and -outs.

In ***Ireland***, financial and technical assistance is provided to SMEs in particular to identify and acquire technology from abroad either as a stand-alone activity or within the context of the enterprise's R&D strategy (i.e. a mix of in-house R&D and technology acquisition). This assistance includes access to 'Innovation Relay' and other networks. Moreover, the country has active policies to help SMEs in particular to identify and acquire relevant technology ('techsearch' activities, assistance with licensing-in technology etc.).

In ***Norway***, bilateral agreements exist on S&T cooperation and technology attachés in prioritised countries work on technology monitoring and transfer and commercialisation. The organisation 'Innovation Norway' is governed by the Ministry of Trade and Industry, and has been given the task of securing transfer of knowledge and technology from abroad to, in particular, Norwegian companies, to map the possibilities abroad for technology, products and services developed in Norway and to contribute to networking between Norwegian trade and industry and research and development actors abroad. Innovation Norway is cooperating with the Research Council of Norway. The organisation has dedicated technology attaches performing technology tasks in North-America, Asia and Europe, but other offices abroad – around 30 all together – also focus on knowledge and technology in addition to the main task of assisting Norwegian companies in their market and internationalisation activities. Information gathered by the technology attaches is also useful for S&T policy development.

In general, few differences in policy measures exist for the international exploitation of knowledge within EU and outside EU. The most important difference can be found in different opportunities due to the EU Framework Programmes. In this respect, cooperation with EU countries in the Framework Programme follows the rules which are laid down in the programme for IPR etc. For cooperation outside the EU IPR may be covered at a general level by bilateral state-to-state agreements.

However, in some cases there are some particularities towards developing economies. For example, the Dutch government encourages the use of new knowledge in developing countries (WOTRO scheme and IS Academy), and in Germany national programmes exists which explicitly aim at the international utilisation of German know-how through German industries in cooperation with foreign partners (e.g. in the field of water technology – see box below).

Practice Example: ***International utilisation of German know-how by German industries in cooperation with foreign partners – the German funding programme on water technology.***

Accounting for the German water industry as only one example for 'win-win'-generating, achievable through synergetic and mutual action, the Federal Ministry of Education and Research (BMBF) had set up in 2000 a so called action concept 'Sustainable and competitive German Water Industry'. The underlying idea is obvious: many regions of the world have immense water problems (scarcity, low quality). German technology has a high reputation, but in many of the concerned countries, which – at least partly – also show considerably economic growth rates, German companies are so far underrepresented. In general, research contacts can be the first step for future business relations (trust building, in situ-demonstration of German know-how).

Through concerted action of research institutions and relevant companies, the market penetration should be enhanced and especially SMEs encouraged looking at new markets and world wide cooperation.

One part of the action concept dealt with projects combined under the header 'Export oriented R&D' (A-Drinking water, B-Waste water) with the task of proofing to which extent 'already good practice in Germany'-measures could be used in other regions of the world - under local circumstances. Immediate aim: generating a structured, reliable pool of experiences for engineering tasks in other countries.

For strengthening international exploitation of knowledge by German companies internationally placed calls are launched with focus on cooperation with dedicated target regions. Here, the classical set up of project partners ('2 plus 2') includes in general at least one partner from a research institution and one from industry on the German side plus the mirror image set on the side of the partner country.

Special partner countries in recent years were Israel (Palestine, Jordan), Japan, China, Indonesia, Russia, Vietnam, Iran.

One of the obstacles of free flowing information between international partners is the concern of protecting rights and to attribute fair ownership. Here the project partners will be particularly trained.

Another chapter of the action concept 'Sustainable and competitive German Water Industry' pointed out that 'knowledge' per se is one of the most valuable assets and that bilateral information, education and exchange on scientific as well as 'pure' human level can be the key of future cooperation in research, science and industry. For that reason the BMBF-scholarship programme IPSWaT (International Postgraduate Studies in Water Technologies) was set up in 2001. Meanwhile more than 210 students and alumni from approx. 60 countries have been elected to that programme. They attend Master (2 years) or Ph.D. (3 years) courses in Germany. The future researchers and decision makers will be provided with higher qualification and excellent contacts in Germany. The contact and information flux are/will be continued through strong Alumni network activities. The participants are encouraged to work with German partners in the future. So far the still young programme has shown very good results in that respect. Furthermore German industry partners and consultants in the field became sponsors of IPSWaT.

Major changes and new initiatives

A number of countries recently made or envisage major changes or new initiatives in the field of international exploitation of research. Major changes over the last years occurred in Germany by means of the Introduction of a Research Marketing/Promotion programme (including the promotion of S&T services abroad) in 2005, and in the Netherlands via the introduction of the 2g@ther programme at the end of 2006.

Practice Examples: New policy measures to foster international exploitation of R&D

Through the 2g@there programme, the Ministry of Economic Affairs from ***The Netherlands*** supports companies that intend to join forces in their international business dealings. Groups of companies that want to focus on opportunities abroad can obtain long-range support. The programme is carried out by the Agency for International Business and Cooperation (EVD) in commission of the Ministry of Economic Affairs.

In a proposal, known as a vision document, the companies explain which opportunities there are and which obstacles interfere with these opportunities. If the vision document is approved, the EVD will develop a three- to four-year programme in cooperation with the group of companies. The objective will be to remove the obstacles.

The programme includes a new way of working in dialogue and tailor-made. In dialogue means that The Ministry wants to engage in an ongoing dialogue with the business community in order to identify new opportunities. The EVD is eager to work with businesses to develop programmes in the appointed countries and sectors (emerging countries and promising sectors). Within these countries or sectors, the business partners select the specific topics that are intended to focus on. Tailor-made means that any ideas arising from this dialogue should be described in a vision document. Here is where partners identify their objectives, resources, the activities planned to carry out and the organisational structure needed to enter a promising market or sector.

The EVD will evaluate the document according to the following criteria:

- international positioning: are the plans ambitious enough and are they geared to a long-term presence in the foreign market concerned?
- impact on sustainable economic growth: does the market/sector combination chosen offer Dutch businesses a sufficiently large potential market?
- commitment and involvement of businesses: are the businesses involved ambitious and motivated enough, and do they have the right organisation to achieve their aims?
- role of government: why is it necessary for the government to support the partner companies in their international activities?

After the proposal has been approved the project will be developed. The EVD will provide tailor-made assistance, for example by removing legal or regulatory obstacles, by intervening with other public bodies, by organising foreign missions, by extending diplomatic aid or help via financial programmes.

The focus of the programme is at emerging countries and promising sectors. 2g@there focuses on the areas in which Dutch businesses can compete internationally. Emerging countries include China, India, Ukraine, Russia, Turkey and the Western Balkans (Bosnia-Herzegovina, Macedonia, Serbia, Montenegro and Albania). The Ministry will potentially support international business dealings in these countries in every possible economic sector.

The Ministry has identified five promising sectors in which Dutch businesses are powerful innovators. They are High-tech Systems & Materials, Water, Food & Flowers, Life Sciences & Health, and Chemicals. There are a further three sectors that offer enormous opportunities at international level: Energy, Infrastructure and the Creative Industry. The Ministry will potentially support international business dealings in these sectors in every country in the world.

In 2005, the ***German*** government has launched a new initiative for a strategic promotion of Germany S&T abroad lead by the Federal Ministry of Education and Research (BMBF). Under the slogan 'Research in Germany – Land of Ideas', German's attractiveness, including that of its research system, is to be presented in important target countries, and German research establishments, competence networks and strong research-based companies are to present their activities, strengths and potential for cooperation.

On the basis of the good cooperation to date, South Korea, a renowned emerging high-tech country in Asia, has been chosen as primary partner for starting this campaign. The aim is to increasingly initiate S&T collaborations between German and South Korean research establishments and companies which are to benefit both sides. Furthermore, special efforts are to be made to attract direct investments to Germany.

During the period from August 2006 until the end of 2007 interested partners in Korea will be provided with numerous opportunities for contacts with German research establishments and strong technology-based companies within the framework of further branch-specific presentations of the German research and technology landscape. Plans include in particular presentations at expert conferences and meetings, as well as workshops, multiplier events, partnering events and lectures, which are addressed on the South Korean side to scientists and decision-makers at universities and in R&D-oriented companies, and to young scientists, multipliers and investors. On the German side, S&T institutions, centres of competence, innovation networks and clusters and business enterprises participate in the initiative to present their strengths in research and development in the field of life sciences, optical technology, maritime technology and polar and marine research as well as innovative energy technologies. First results are a substantial number of Memorandums of Understanding (MoU), Letters of Intent (LoI) and concrete 2+2 Cooperations between German and South Korean partner institutions involved.

Building upon this pilot activity, further sector oriented initiatives in the field of nanotechnology and environmental technology will be launched within the next months.

New initiatives related to the exploitation of national research in Third Countries or national exploitation of research developed in Third Countries is envisaged in at least seven countries. Five of them already have in mind concrete actions to be taken. In Romania further development of instruments will be undertaken to promote public-private partnerships, especially in FDI-based industries. Germany is developing a new approach to international networking and international cluster policy including the systematic access to foreign knowledge for exploitation by German institutions (together with their foreign partners). The Turkish Patent Institute plans to establish an autonomous Patent Evaluation Agency that aims at technology evaluation and evaluation of firm's intellectual capital. In the context of better coordination between S&T policy and development policy, more attention will be paid in The Netherlands to the production and exploitation of knowledge in developing countries. In Greece, the 'BONUS' programme will contribute to the exploitation of the results of knowledge. A wide range of

Table 4.10: Major changes and new initiatives in policy measures towards the exploitation of research

Exploitation of domestic research in Third Countries: major changes over the last years	Domestic exploitation of research developed in Third Countries: major changes over the last years	New initiatives to be envisaged
Germany The Netherlands	Greece Romania	Romania Germany Greece Ireland Turkey Sweden The Netherlands

Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

funding schemes will be eligible for this purpose. In Ireland, new initiatives may emerge in the context of Ireland's internationalisation strategy for STI which is currently under development. In Sweden, there might be a need for new initiatives as Sweden has a new Government which will present their research bill in autumn 2008.

Practice Example: Germany's Proposal for a European Charter for the Management of Intellectual Property

The active professional management of intellectual property is a major factor which shapes the cooperation between research institutions and industry and which is crucial for innovation and the resulting competitiveness of the European Union. Therefore Germany proposed during the German Presidency the establishment of a European Charter for the management of intellectual property from public research institutions and universities (IP Charter).

The IP Charter is meant as a frame of reference which could be used on a voluntary basis by cooperation and/or negotiation partners for settling any issues relating to intellectual property rights in available or future research results. The establishment of an IP Charter would provide a Community framework ensuring consistent management throughout the EU of research results generated by collaborations between publicly funded research institutions and industry.

The purpose of the IP Charter is to highlight a common European understanding and common values with regard to the management of intellectual property in the field of research. With an IP Charter, the European Community would at the same time be able to meet the challenges of advancing globalisation and the increasing international competitive pressure. An IP Charter would clearly signal to Third Countries and international research partners that the European Community has agreed on common values and standards for the management of intellectual property in research collaborations. Europe would thus document its understanding of the fair and just management of intellectual property – including all categories of intellectual property which would be covered by the broad scope of the Charter.

This proposal of the German Council Presidency is based on a variety of national and international surveys, reports and other documents (e.g. Responsible Partnering Initiative (EIRMA, EARTO, EUA, ProTon Europe), CREST Report (CREST OMC Expert Group).

The aim of the IP Charter is to raise general awareness of the professional and fair management of intellectual property in the European Research Area. The IP Charter is addressed to the Member States, which are to be encouraged to support the establishment of principles for the proper management of intellectual property. In addition, the IP Charter is addressed to public research institutions and universities, which are to be encouraged to upgrade their management of intellectual property in accordance with the standards proposed by the Charter. However, the IP Charter would in fact affect all potential cooperation partners.

The Competitiveness Council in Luxembourg on 25 June 2007, in its conclusions to knowledge transfer, invites the Commission to develop an European Charter on Intellectual Property Rights, that should follow the precedent of the European Charter for Researchers[35].

Conclusions

The policy objective as regards the international exploitation of knowledge is to find a balance between protection and dissemination of knowledge. A large group of MS/AS have a balanced view on the international exploitation of research. Some have an open view and an almost equally big number has no clear opinion (yet) on this matter. No MS/AS has a closed approach. Among the countries with a balanced view, regulatory interventions in the field of IPR protection and exploitation are usually made on case-by-case basis. Most common, however, is the inclusion of IPR regulations in S&T and other relevant bilateral agreements. Specific measures to promote protection of knowledge generated by domestic universities and research centres are perceived with an increasing important priority, but concrete measures are still rare.

Summarising, it should be considered by national policy makers to:

- stronger promote the rationale of the model of open innovation within funding programmes to provide more flexibility on how to use the granted money. This should allow funding[36] of those activities, which are very often just beyond or on the brink of R&D programmes, such as skills upgrade and informal and formal training of technicians and researchers, study visits to potentially new (knowledge) suppliers, legal advice, closer interaction with producer-services etc.
- promote S&T instruments and support measures designed to identify and acquire technologies, licences etc. from abroad (e.g. legal advice by technology counsellors)
- set-up policy measures to cooperate in a sustainable way with developing countries in the field of knowledge transfer and technology development for the mutual benefit of both partners involved (eventually in stronger coordination with Official Development Assistance - ODA - policies).
- set-up comprehensive national measures to stimulate and support the international exploitation of research. Here, a balanced approach involving different ministries and

35 Council Conclusions on Knowledge transfer and the use of intellectual property in the European Research Area (10145/07 EDUC 106 RECH 164 COMPET 175), 25 June 2007: In its conclusions, the Council welcomes the German Presidency's initiative in moving forward a process to establishing a voluntary charter for the use of Intellectual Property from public research institutions. The Council invites the Commission to develop such a European Charter based on a structured dialogue with stakeholders, building on the policy orientations on the sharing of knowledge put forward by the Commission. The Commission is also invited to make suggestions for the sustainable improvement of international research cooperation through the transfer of relevant knowledge. The Intellectual Property Charter should follow the precedent of the European Charter for Researchers in addressing all relevant decision-makers and should be on a voluntary basis.

36 Of course within the framework of unprohibited state-aid regulation.

other relevant stakeholders should be foreseen for the benefit of progressing research and technological development as well as for the benefit of economic growth.

It is recommended that policy makers in Member and Associated States:

vi. set a (regulatory) frame and support (incl. funding) activities of national S&T institutions and innovative firms allowing on the one hand better access to foreign knowledge and on the other hand a fair exploitation of domestic knowledge in Third Countries.

5. Coordination of Member States'/Associated States' internationalisation policies and strategies towards international organisations

Following the analysis of national policy approaches and implementation measures towards the internationalisation of S&T with Third Countries presented in chapter 3 und 4, chapter 5 deals with the trans-national policy coordination. Section 5.1 gives an insight into the present stage of coordination in terms of national motivations and objectives and instruments applied. Since Community instruments turned out to play the most important role, section 5.2 reflects particularly on present and future Community instruments and summarises recommendations for optimising the performance of the established ERA-NET mechanism from the perspective of the coordination activities towards Third Countries. Section 5.3 describes the practice of MS/AS to participate in international organisations. A summary of lessons learnt including barriers for trans-national policy coordination is subject of section 5.4. Finally section 5.5 proposes recommendations to further develop policy coordination among Member States and Associated States including Community actions.

Main conclusions:

I. The majority of MS/AS sees a strong need for trans-national coordination of S&T policies towards Third Countries. Most of the MS/AS apply to some extent respective mechanisms. Major objectives are to share expertise as well as experience to learn lessons, to undertake joint activities and to share efforts. In view of the ambitious goals of developing the European Research Area, there is much room for improving the coordination of S&T policies.

II. In terms of coordination instruments, Community instruments such as ERA-NETs and INCO-NETs are of utmost importance for MS'/AS' coordination activities. However, Community instruments could be used more extensively and in a more strategic way for policy coordination of international S&T cooperation, what still requires some reshaping of the instruments to meet the particular needs.

III. International organisations potentially provide a strong tool for coordinated activities of their members. There is a need to raise further awareness for the opportunities and benefits of participation in international organisations. The EU could play a leading role in international organisations based on coordination of MS and the European Commission. With this respect, suitable and efficient mechanisms are still lacking.

IV. Major barriers for trans-national coordination are differences in national legislations and administrative regulations, lack of coordinating capacities, lack of awareness on the importance of policy coordination towards Third Countries and in some ways competition between MS/AS based on national strategic interest.

V. Focussing on areas of common interest, there are a number of options to enhance the cooperation and coordination among MS and AS contributing to better coherence, complementarity and efficiency of policy actions. Concrete recommendations addressed to S&T policy stakeholders at national and Community level are given. Of particular importance is to establish a high-level strategy forum on international cooperation with the relevant policy stakeholders from the Member States and the European Commission with an appropriate support structure.

5.1 Present state of trans-national coordination of S&T policies

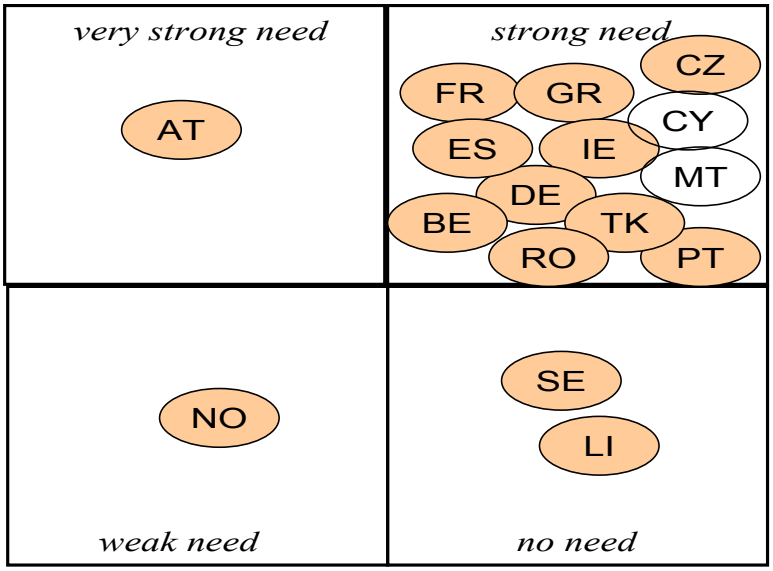
Following the general outline on national strategies in chapter 3, this section describes the present state of coordination of S&T policies[37] towards Third Countries among the Member States and Associated States including objectives, instruments and its dynamics.

In summary, based on the preliminary analysis of the CREST questionnaires about three quarter of the Member States/Associated States apply to some extent mechanisms for trans-national coordination of S&T policies towards Third Countries. In addition it was found, that more than 60% of the 19 countries which replied perceive a strong or even very strong need for enhanced trans-national coordination.

Most countries, by exception of Liechtenstein, Lithuania, Poland and Sweden have a range of mechanisms in place to apply some kind of trans-national coordination of national policies for an internationalisation of S&T towards Third Countries. Moreover the majority of countries also felt a certain need for coordination of S&T policies towards Third Countries in-between the European Union' member states and countries associated to the European Framework Programme for RTD (see Fig. 5.1).

Figure 5.1: Perceived need for coordination of S&T policies towards Third Countries

Note: Cyprus and Malta are not members of this CREST Working Group and are thus represented without colour



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Liechtenstein and Sweden reported that they do not have any further need for trans-national coordination (exceeding the CREST Working Group). Norway reported a weak need. An indifferent assessment towards this issue was given by Lithuania, The Netherlands and UK. In Belgium the perception for more or less coordination differs between an indifferent and a strong need at the regional level. Austria reported a very strong need for enhanced coordination. However, the majority of respondents indicated a strong need for coordination. No answers were given by Denmark and Poland.

37 Coordination of policies addressed the definition of common policy objectives and respective coherent, complementary or joint implementation measures building on national interests and aiming at mutual benefit.

The major **objectives** for those countries who apply trans-national coordination of national policies for an internationalisation of S&T towards Third Countries are

- sharing expertise and experiences to gain information as well as to learn lessons in view of the challenges of international S&T cooperation;
- undertake joint activities and sharing efforts.

The latter objective is very often pursued under European initiatives. Other objectives include:

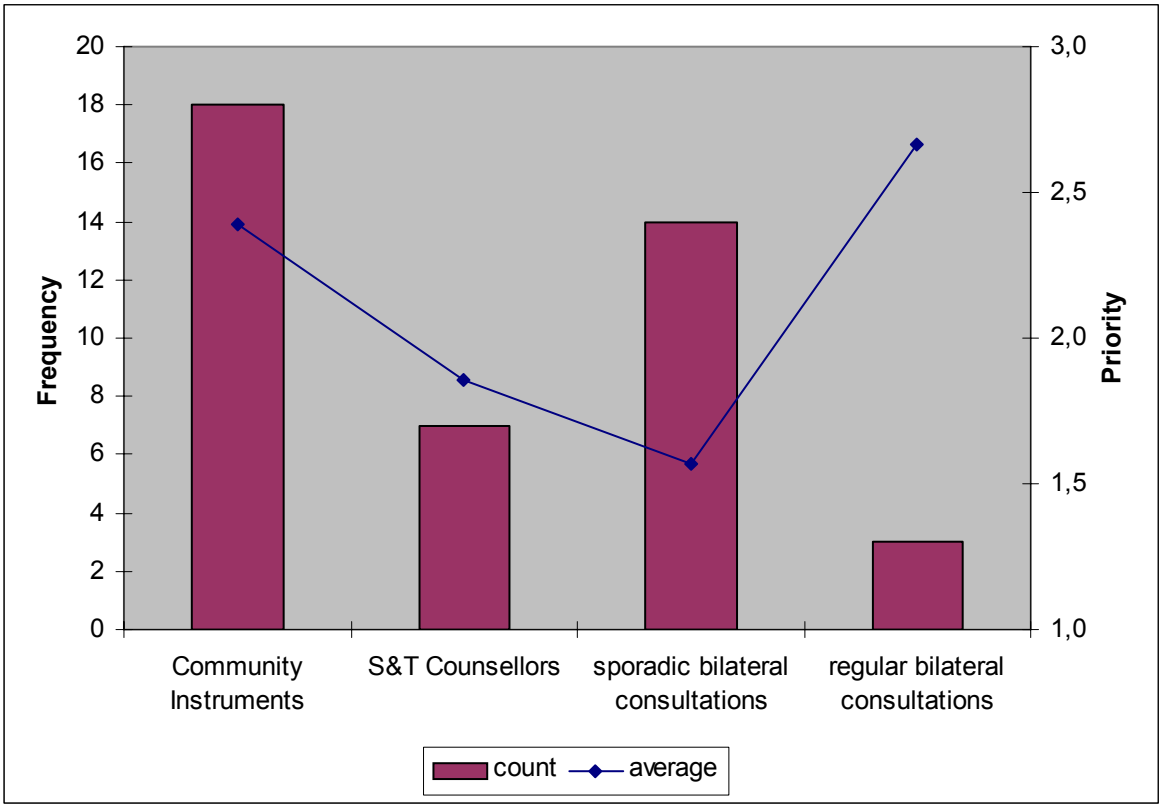
- increasing the European visibility and to open the ERA to the world;
- promotion of European IPR standards;
- using common platforms to intensify the cooperation with Third Countries;
- identification of priorities of joint actions;
- development of synergies with a focus on FP7 priority areas in order to increase the number of joint applications and projects;
- facing global challenges jointly.

In general, trans-national coordination is perceived as a means to strengthen national efforts in the field of internationalisation, to add critical mass to national efforts, to overcome segmentation of singular activities, to avoid duplication of efforts and to increase the impact. The potential benefit of using already available resources of other MS/AS (e.g. agencies, labs, strong research teams, specific equipment) to implement own national ideas or projects, e.g. in Third Countries, was not addressed yet (e.g. in the area of development cooperation for instance, Austria uses [and pays] public Swiss agencies to receive certain knowledge based services).

In terms of **coordination instruments**, Community instruments were highlighted to be of most importance. Those instruments were introduced in particular through the 6th EU RTD Framework Programme (Specific Support Actions and Coordination Actions such as ERA-NET) and even strengthened through the 7th EU RTD Framework Programme (Coordination and Support Actions, ERA-NET (plus) and INCO-NET).

All respondents who gave an answer on the question *'Which coordination instruments are applied?'* reported, that they participate in community instruments which support the coordination of EU-Member States activities in the field of international cooperation with Third Countries (ERA-NETs, SSA). In total 18 countries replied to make use of these coordination instruments (see Fig. 5.2). The second most often used instrument is the one of sporadic bilateral consultations (n=14). Only seven countries make use of S&T counsellors to apply trans-national coordination and only three cases reported on regular bilateral consultations. Two of these three countries assigned also highest priority values to this kind of instrument. The coverage of dialogue partners within these regular bilateral consultations is, however, limited to one respectively two partner countries, out of which all are members of the EU.

Figure 5.2: Coordination instruments applied by MS/AS



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

The general trend is unambiguous: the participation in European community instruments did not only receive the highest number of counting, but – by exception of the few cases of regular bilateral consultations – also the highest priority value. The community instruments are usually also perceived as the most successful instruments, because they stimulate learning and generate outcome and – from a more practical point of view – because they are tangible and provide an EU-label as well as funding, resources and commitment. The respondents gave high emphasis to both instruments (ERA-NETs, SSA), but slightly more to ERA-NETs.

Among the ERA-NETs, CO-REACH (although with yet limited evidence) and SEE-ERA.NET were quoted as successful examples, especially in terms of mutual learning, best practice exchange, coordination of efforts, reduction of duplication and strengthening of impact as well as in terms of developing and launching joint calls for proposals (the latter only in respect to SEE-ERA.NET). Some of the responding countries perceive an ERA-NET rather as basis for the consolidation of links, while others exploit more actively the coordinative role of this instrument between national funding programmes.

Practice example: The Southeast European ERA-NET

The SEE-ERA.NET consists of science ministries and agencies from Albania, Austria, Bosnia-Herzegovina, Bulgaria, Croatia, France, Germany, Greece, Hungary, Former Yugoslav Republic of Macedonia, Montenegro, Romania, Serbia and Slovenia. All partner countries are equally footed in the project. They receive FP6 money for coordinating their activities. The consortium invites also additional partners to join forces.

In the first two years, the consortium invested in strategic dialogues, trust-building and in generating evidence-based decision basics. In 2006 a first call for proposal was launched among all partner countries resulting in 32 financed multilateral projects consisting of 161 research teams from the fields of environmental technologies, application research in ICT and sustainable production and management of biological resources from soils, forests and aquatic environments. For this purpose a common pot was established, partly virtual (i.e. each partner pays the costs of its participating researchers) and partly real. The real common pot amounted to 20% of the total budget. It was mainly used for the financing of joint summer schools. The administration of the joint call was partly subcontracted out to INTAS which proved to be very efficient and professional.

SEE-ERA.NET is now in the process to prepare a more comprehensive regional programme with several sub-schemes. They should focus more on larger collaborative multilateral research projects, an upgraded mobility component and more emphasis on SME integration and innovation support.

Besides these activities also other helpful joint undertakings have been developed and implemented such as a joint evaluators database, a joint inventory of bilaterally funded projects, joint strategic conferences and policy coordination meetings and joint awareness raising initiatives.

Values attributed to SSAs include 'flexibility', 'effectiveness' and 'door-opener for international contacts and experience' or in the words of Austria *'SSAs are effective and flexible instruments with high efficiency'*.

Lowest priority value was given to sporadic bilateral consultations, although they seem to happen quite often which could cast doubt on the adequateness and efficiency of this instrument. Also the priority value attributed to the work of S&T counsellors in terms of transnational coordination received just a slightly below average mark.

Practice example: Science and Technology Officers at The Netherlands' Embassies

The Netherlands Ministry of Economic Affairs has stationed Science and Technology Officers in *Washington DC and San Mateo (Silicon Valley) - covering the US and Canada, Tokyo - covering Japan and Taiwan, Seoul ,Singapore, Beijing and Shanghai, New Delhi, Brussels - covering EU affairs, Paris, London - covering UK and Ireland, Berlin, Stockholm, Helsinki and Rome.* The network is supported by the Central Science and Technology Office at the Ministry of Economic Affairs in The Hague. The services provided by the Science and Technology Officers' network are tailored to companies, universities and knowledge institutes based in the Netherlands. The focus is on innovation, R&D trends and technological developments abroad. The services are summarised below.

The officers respond to queries coming from (entrepreneurial) researchers, high-tech SMEs, starter companies, university researchers, research institutes, policy makers, investors and business angels who are focussing on R&D and applications of technologies in The Netherlands.

The network publishes *TWA Nieuws*, a Dutch bimonthly periodical on R&D developments and trends. There is also a website. The science and technology officers assist to establish international contacts on R&D matters as well as R&D partnering.

Each year two conferences are dedicated to an S&T related theme, e.g. innovative technologies in the water sector or nanotechnologies. Prior to each conference a special issue of *TWA*

Nieuws is published, providing detailed overview on S&T developments and state-of-the-art in the countries covered by the network. The objective of the conferences and the special issue is to inform the participants about international trends in R&D related to the theme selected. Speakers from countries covered by the network are invited to serve as a sounding board and source of inspiration.

For the **dynamics of trans-national coordination activities**, the new FP6 instruments (especially ERA-NETs) were perceived by more than half of the respondents as the most remarkable changes in policy measures for trans-national coordination of R&D policies towards Third Countries during the last years. Just two countries reported no changes. Other, however only singularly reported changes, include the attempt to work bilaterally on joint-scenario development and to direct more emphasis on the cooperation with regions (e.g. Black Sea, Central Asia) rather than with specific singular countries. One reference was given to the importance of OMC. One country found fault with the low participation of Third Countries in FP6 which is perceived as a reason for concern by the respondent and which ought to call for a change.

Seven countries reported that they are envisaging some new initiatives from their side for future coordination mechanisms (Austria, Germany, Greece, Ireland, Malta, Spain, The Netherlands). Almost all refer to the establishment of or participation in INCO-NETs, ERA-NETs and ERA-NET plus.

5.2 Reflection on present and future Community instruments to foster coordination of Member States'/Associated States' policies

The analysis of coordination mechanisms described in chapter 5.1 showed that mechanisms like the Open Method of Coordination (OMC) or Community instruments such as Specific Support Actions (SSA) and Coordination Actions (CA) are highly accepted by the Member States and Associated States and are the most frequently used instruments for policy coordination. For this reason this section enters into an in-depth reflection with emphasis on the instruments of the RTD Framework Programme, such as ERA-NETs and INCO-NETs.

The ERA-NETs were introduced within the last years as an instrument to support the building of the European Research Area. They are considered to be very effective and flexible, generate learning and avoid duplication. Looking at the new instruments of the 7th EU RTD Framework Programme in addition to the 'regular' ERA-NET mechanism, the INCO-NET and ERA-NET plus schemes will provide new options for enhanced coordination.

However, it should be stated that the majority of FP6 **ERA-NET activities** were not meant for the development of the international dimension of the ERA through a coordination of S&T programmes of Member States and Associated States towards or with Third Countries. There are 6 out of 71 Coordination Actions with an explicit focus on international cooperation (3 regional ERA-NETs with a target on Western-Balkan Countries, China and Latin America and three thematic ERA-NETs of international dimension targeting Agriculture, Security and Water Research). Looking at the participation of partners from Third Countries, there are only 8 Third Countries (Russia, Canada and the six Western Balkan Countries) participating in only five ERA-NETs.

As far as the role of ERA-NETs on the coordination of international S&T programme owners is concerned, there is room for a more extended use. Joint programmatic initiatives in strategic research areas with programme owners in highly industrialised countries (USA, Japan,

Canada) as well as joint initiatives with Candidate Countries and countries of the Neighbourhood Region (e.g. MEDA, Black Sea) are still missing. This would allow a better coherence of the S&T activities and their closer integration in the wider concept of the ERA. A more inclusive role of the Third Countries, allowing participation at the same level as the Member States and Associated States would be essential.

Complementing the ERA-NET scheme, there are some **SSA and CA** under the 6th EU RTD Framework Programmes, which are dealing with mapping and structural S&T issues in and with Third Countries. Comparable activities might be envisaged also by CSA type of activities under the 7th Framework Programme. The knowledge obtained under these projects has not been fully exploited yet. For this purpose, however, special new information and dissemination channels have to be developed.

New momentum to the coordination activities was given by the present **CREST Working Group on internationalisation of R&D**, which provides room for a mutual learning exercise and the development of new concepts for closer coordination of R&D policies towards Third Countries.

To complete the picture of existing Community instruments and looking at the 7th EU RTD Framework Programme, there is much expectation in the MS/AS related to the new instrument of the **INCO-NETs** allowing a systematic bi-regional dialogue with major regions of the world (Eastern Europe and Central Asia, Mediterranean Region, Western Balkans, ASEAN countries, Africa and Latin America). It is acknowledged, that existing coordination instruments like the Monitoring Committee for the S&T cooperation with the Mediterranean partner countries (MOCO) and the Steering Platform on Research with the Western Balkan Countries will be strengthened through providing operational and knowledge based tools. For the other regions, such dialogue structure will be enabled through the INCO-NET mechanism for the first time.

One new element supported via the INCO-NETs is the **coherence of different community policies targeting Third Countries** highlighting in particular the RTD Framework Programme and the international development policy reflected by the instruments of foreign assistance (like European Neighbourhood Policy Instruments and Development Cooperation and Economic Cooperation Instruments). It is expected, that this will trigger a complete new approach of policy coordination at Member States level and between Member States as well.

Another relevant Community instrument allowing a better coordination of Member States/Associated States activities is the European Researcher's Mobility Portal, which is a joint initiative of the European Commission and the 34 countries participating in the European Union's 7th Framework Programme, involving the creation of national researcher's mobility portals which are targeted towards both EU and Third Country researchers.

Finally, there is a number of Community instruments which are so far not well harmonised with Member States activities referring most prominently to the **S&T agreements between the EC and selected partner countries,** the network of **EU science counsellors** in distinguished Third Countries and the **participation of the EU and the Member States in international organisations**. Here, the respective community instrument could play an integrative role to provide at least to some extent an umbrella for activities of the Member States and Associated States.

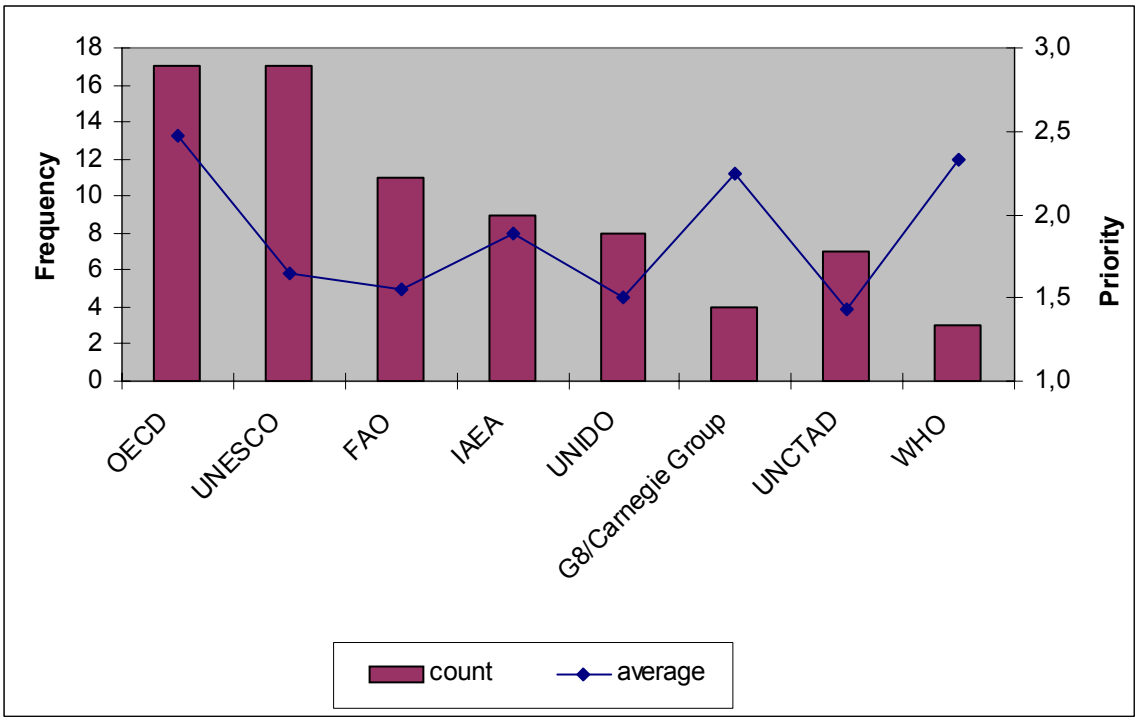
5.3 National strategies towards international organisations

International organisations potentially provide a strong tool for planning and implementing activities in the joint interest of their members usually focussed on dedicated fields of action. With this respect they also provide a common umbrella for cooperation and coordination among their members building on joint interest and aiming at mutual benefit.

This section analyses the present state of strategic governmental approaches to a proactive participation in intergovernmental and other international organisations, which are of particular relevance for S&T.

From all international organisations outside of the EU, the OECD was generally perceived as most important international body influencing S&T policy shaping (see Figure 5.3). If non-OECD members are excluded, the priority value assigned to OECD reaches 2,9 which is almost at optimum. Evidently, non-OECD members do not value the influence of the OECD on S&T policy shaping as much as OECD members. UNESCO was mentioned as frequent as the OECD, but the priority value assigned to UNESCO is considerably lower (1,6) than the one for the OECD across all respondents (2,5). Although the influence of the UNESCO is below average in general, it is usually significantly higher among the new EU member states and associated countries (2,0). All other international bodies featured in Fig. 6.3 rank with descent interspace, out of which FAO, IAEA and UNIDO are most often mentioned. Quite a high priority is assigned by a handful of respondents to WHO and – by countries which are members – to G8/Carnegie Group.

Figure 5.3: Influential non-European international bodies on S&T policy



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

The human resources approach of the respondents towards an active participation in relevant international S&T bodies varies considerably. There are some countries, such as the Czech

Republic, France, The Netherlands, Norway, Romania and Turkey, who implement a wide spectrum of measures in this respect ranging from awareness raising on job opportunities to secondments of national experts paid by national funds. Other countries focus more on selected specific measures (e.g. Cyprus, Lithuania, UK) or assign a lower priority to this issue in general (e.g. Malta, Sweden). In general, however, the following three measures are most often used by the majority of countries:

- active communication and cooperation of national S&T administrations with domestic experts (expats) working in international organisations;
- active delegation of civil servants or national experts in governing boards, management councils, advisory groups of international organisations etc.;
- awareness raising, promotion and information dissemination of job offerings.

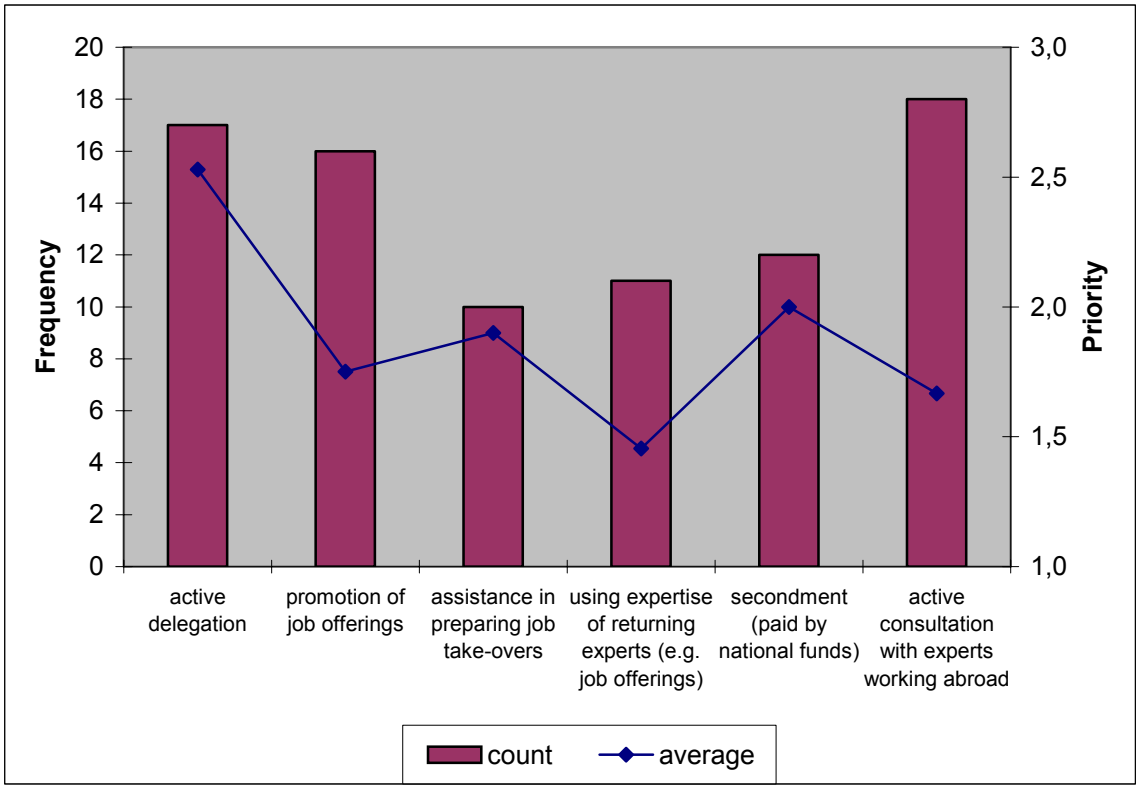
Among the instruments available, an **active delegation approach** is ranked with highest priority (see Figure 5.4). It is perceived as an effective instrument, because of the personal and institutional increase of experience and knowledge. In addition, it enables the receipt of first-hand information and thus, among other things, an early awareness on emerging new initiatives. Another important issue is to participate in decision-making processes as well as to learn from experience of other countries. It has also been mentioned, that an inclusion in decision-making processes of international S&T organisations increases the commitment and ownership at home (i.e. within the national policy making processes).

In terms of assigned priority, this instrument is followed by the instrument of seconding national experts paid by national funds and measures to provide practical assistance to those experts, who will take over jobs in international organisations. The strategic value of seconding experts paid by national funds lies in the proximity to national interest and priorities. The still existing close link of seconded experts with and through their home institutions is seen as a major institutional asset in this respect.

It was found, that a presumably self-evident use of the expertise of national experts who return home from international organisations is not as self-evident as anticipated. It seems to be even rather precarious in some countries. Despite the fact, that it could be tackled by a broad spectrum of activities, ranging from some low-cost activities (e.g. inclusion in light regular consultation meetings; inclusion in advisory groups etc.) to more advanced approaches (e.g. offer of adequate national job positions), it seems that some structural barriers exist, which prevent a full exploitation of this instrument in some countries. But even in those countries which take care about returning expats, this instrument receives in general just below average priority by those who apply it.

Also the average priority assigned to the active communication and cooperation with expats working in international organisations is rather low. All this points to structural causes, which hinder a steadily communication and information exchange flow between ministries and experts working in international organisations. The availability of a dedicated structure for information exchange is seen as important success factor in this respect. Of course, loyalty and confidentiality restrictions of national experts working in international organisations need to be respected.

Figure 5.4: Instruments and approaches to work with national experts in international S&T relevant organisations



Source: Policy questionnaire on the internationalisation of R&D – CREST WG on policies towards the internationalisation of R&D (Annex a)

Nine countries responded that their national administration does not implement any measures to coordinate S&T related activities with other countries in international bodies. Other countries reported some sporadic ad hoc coordination measures (e.g. Czech Republic, Portugal, Spain) or informal contacts (e.g. Austria). Other make more structured use, for instance through their permanent representations at international organisations (e.g. The Netherlands), partially on basis of regional coordination mechanisms and processes (e.g. Nordic Countries) or on basis of bi- and multilateral S&T agreements (e.g. Romania).

Only a handful of countries reported that major changes in policy measures for a proactive participation in international organisations were implemented in the last years. The emphasis on these new measures seems to be rather a result of a general process of allocating higher awareness to the issue of internationalisation of S&T than to be a singular response to S&T relevant international organisations.

5.4 Lessons learned and existing barriers for cooperation and coordination

In general terms, in the last years there is a tendency of the Member States and Associated States for a closer cooperation at S&T policy level towards or with Third Countries. Saying this, cooperation and coordination needs to be built on national interests of Member States, Associated States and – if appropriate – Third Countries and needs to prove clear benefits for all parties involved.

So far, this process has been driven by new Community instruments like ERA-NETs or mechanisms like the Open Method of Coordination (OMC) through CREST and its working groups. What still needs to be strengthened is the degree of political commitment by interested Member States/Associated States to undertake real action. Sometimes also the EC herself is called for more commitment.[38]

It should be noted, that there are some more centrifugal factors based on competition or specific geographical, linguistic and cultural ties, which plead for a more national approach.

However, there is still much room for improving the coordination of S&T policies starting with a **more extensive and strategic use of established Community instruments** (which to some extent still require some reshaping to meet the particular needs of international cooperation with Third Countries) and building on new instruments like, most prominently, the INCO-NET mechanism, which explicitly involves stakeholders from Third Countries.

In addition, the potential of **policy coordination actions towards of with Third Countries initiated by Member States and Associated States in variable geometries without using Community instruments** needs to be explored building on national interests, instruments and funding. This would provide one of the most sustainable ways of S&T policy coordination, necessary to truly develop the international dimension of the ERA[39].

Our analysis shows, that **harmonization and consistency of the activities of the Member States and the European Commission** could be further enhanced for implementing a leading role of the EU and its Member States in the process of globalisation and in global problem solving. Here, the interrelationship of S&T agreements of the Community and the Member States, the interaction between the EU delegations abroad and Member States embassies and the participation in international organisations are three pillars of major importance. In this respect, often a strong representation of European interest and conviction, based on a joint agreement and understanding of its members, within international organisations is lacking.

Coherence and coordination between the Member States of different policies targeting Third Countries – here most prominently S&T policies and development policies - are for the time being not given much room. Respective national approaches as a precondition for trans-national coordination already exist in some MS. The coordination process for linking different policy areas between Member States will also be supported through the new instrument of the INCO-NETs.

Last but not least there is a need to raise further awareness for the opportunities and benefits of **participation and coordination of EU Member States and Associated States in international organisations** like the OECD or the various UN-organisations. With this respect, suitable and efficient coordination mechanisms including the European Commission are still lacking. Following the recent ERA Green paper of the European Commission it should be aimed that – wherever appropriate and in accordance to national interests - Member States and the Commission 'speak with one voice' in international organisations.

Despite the generally benevolent attitude towards trans-national cooperation of most of the responding countries, it is not healed up that **barriers for trans-national coordination** exist. Most often mentioned are four dimensions in this respect:

- differences in national legislations and administrative regulations which hamper the implementation of trans-national activities (e.g. staff and money transfer; funding regulations; IPR; security issues; safeguarding industrial return);

38 The case of INTAS could be debated in this respect.

39 The 'international dimension of the ERA' refers to the external relations of the European science community.

- lack of coordinating capacities and resources (e.g. lack of professional management competences; lack of personal resources; lack of knowledge resources; high transaction costs of international cooperation);
- lack of awareness of national stakeholders on the importance of a coordinated approach towards Third Countries (which is [a] due to the relative novelty of the topic [keyword: techno-globalisation]; [b] due to the low priority of trans-national R&D cooperation in traditional mainstream R&D policies and strategies; [c] the strong connectivity of international S&T policies with other policies which would require also changes in these other policy domains; [d] lack of dedicated strategies, bodies and instruments [therefore there is need for this CREST Working Group]);
- competition between EU Member States/Associated States based on national strategic interest (e.g. attraction of 'best brains'), which seem to call rather for unilateral than for coordinated bi- or multilateral interventions.

Other obstacles refer to the following issues:

- a general but conscious reluctance against any forced coordination;
- no clear and measurable outcomes and recognition of benefits yet (input-output ratio, spill over effects from international S&T cooperation);
- lack of knowledge on areas of common interest with other Member States or countries associated to the European Framework Programme for RTD;
- cultural differences.

Four countries responding that there are no barriers existing which obviously points to the saying *'where there is a will there is a way'*. This is a clear indication for the existing political commitment in these countries.

5.5 Conclusion: Potential ways of cooperation at the EU level and recommendations for enhanced coordination of R&D policies towards Third Countries between Member States and Associated States

With respect to S&T cooperation towards Third Countries it is expected, that enhanced cooperation and coordination among Member States and Associated States will contribute to better coherence, complementarity and efficiency of Member States' and Associated States' policy actions. However, any kind of cooperation and coordination has to prove its added value[40] and needs to be implemented on voluntary basis. It goes without saying, that coordination does not exclude individual approaches of Member States and Associated States building on specific national or regional interest.

Building on the analytical part of this paper and the OMC discussion, the following options for actions are proposed:

40 In this context, the development of assessment indicators in order to measure successful cooperation and coordination could be invisaged (see option for action ii, chapter 3.3).

1. Identifying the relevant targets for coordination activities building on common interest and mutual benefit

Joint activities should be built on common interest and aim at mutual benefit. Areas of particular competition among the Member States/Associated States are not appropriate for a collaborative approach. In particular this concerns activities which are close to market exploitation and which intend to attract the international academic elite to work in national S&T institutes and S&T intensive companies. In addition, there are different S&T priorities in the different Member States/Associated States, which again could reduce room for cooperation and coordination.

However, options for an enhanced cooperation should be explored in those areas where a number of Member States/Associated States share common goals[41]. Such areas are:

- research better implemented through collaborative research joining academic skills and experience of various European and international research teams;
- research aiming at solving particular problems of developing countries addressing among others the Millennium Development Goals;
- research aiming at solving problems of global impact (e.g. addressing first the strategy for sustainable development incl. climate change and energy efficiency; second international migration flows etc.);
- access to scientific resources in Third Countries (geology, climate, biodiversity, cultural heritage, …);
- development and use of S&T infrastructure built around particular resources of Third Countries;
- share of European standards and models in S&T and promotion of European RTD.

Special emphasis should be given to coordinated European cooperation strategies towards the neighbourhood countries and major present and up-coming international competitors. The results of existing bi-regional dialogue platforms (Monitoring Committee for the Mediterranean Region and Steering Platform on Research for the Western Balkan Countries) and of the up-coming INCO-NETs should be taken into account.

In view of the Lisbon agenda, coordination of Member States/Associated States activities should address major competitors (existing and up-coming like USA, Japan, China, Russia, India, Brazil, South Korea). Here, there seems to be much room for coherent and coordinated European strategies to have a net benefit from the cooperation and to deal with challenges like the legal framework for mobility, IP and ethical issues. Here, one should build on existing instruments and regulations. Previous and recent initiatives like the 'European Charta for Researchers' and the 'European Charter for the management of intellectual property' should be considered. As far as legal issues are concerned, there is a link to recommendation 6 below.

The OECD could, based on its differing member structure, contribute additional knowledge transcending the European perspective.

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41 Common goals include among others: more effectiveness and efficiency of national S&T, implementing MDGs and solving global problems, promoting European technology platforms abroad, access to world markets through European standards.

It is recommended that policy stakeholders from MS/AS and the EC :

vii. work-out a specific agenda with priorities for coordinated actions of MS and AS towards and with Third Countries through a strategic dialogue process involving the European Commission as well and including Third Countries where relevant.

viii. identify barriers and threats for S&T cooperation with Third Countries and develop joint strategies to overcome them e.g. through coordinated policy approaches in terms of a common Community framework (addressing among other issues IPR, mobility aspects, access to S&T infrastructure and resources).

2. Raising further awareness of the needs and benefits of coordination of R&D policies towards Third Countries

Building on an inventory of good practice demonstrated by previous and ongoing coordination activities, which are in particular based on Community instruments (SSAs, ERA-NETs), the needs and benefits should be communicated to the responsible political stakeholders in the Member States. The OMC implemented by CREST is an appropriate instrument.

It is recommended that policy stakeholders from MS/AS and the EC :

ix. identify and disseminate information on success stories of coordination activities taken into consideration
- the outcome of an evaluation of existing coordination instruments on Community level (linked to recommendation *xiv*),
- national approaches to enhanced coordination with other MS/AS and
- joint activities in international organisations.

x. encourage a debate at ministerial level on the topics and instruments of enhanced coordination of S&T policies towards Third Countries.

3. Instruments for a better coordination of activities

Joint activities of Member States, Associated States and the Commission cover
- the exchange of information and mutual learning,
- setting a joint framework for collaborative efforts (funding schemes, IPR, mobility issues, direct investments, …) and
- coordinated or joint actions.

Member States and Associated States would gain already particular benefit from a continuous exchange of information and experiences on S&T in Third Countries including the policy framework, ongoing collaborative activities but also barriers and threats including good practice to overcome them.

Substantial knowledge is available at Member States and Associated States level, which needs to be presented and analysed in a structured way through discussion forums, mutual learning exercises and joint data bases. Here, the ERAWATCH service of DG Research and the Joint Research Centre/IPTS might be systematically extended to major Third Countries[42]. Additional Community instruments for gaining and disseminating information are horizontal ERA-NET and the upcoming INCO-NET information platforms. Where appropriate (e.g. statistics)

[42] Today, already 9 countries that are neither EU Member States nor Associates States are covered by ERAWATCH.

a strong working relation of INCO-NETs with international organisations (e.g. UNESCO, OECD) should be encouraged.

In addition, the mutual learning exercises as part of the CREST OMC activities provide an appropriate instrument extending the present OMC Working Groups on Internationalisation of R&D policies.

The framework for joint S&T activities of trans-national scientific consortia of Member States/Associated States and Third Country research teams needs to be developed. There are widely established bilateral programmes. However, apart from the systematic opening of Community instruments, some specific initiatives or programmes of a group of Member States/Associated States and Third Countries (such as Northern Dimension, BSEC, …) and European and international organisations (EUREKA, COST, ESA, OECD, UNESCO, WHO…) there is no appropriate environment for multilateral (i.e. bi-regional) S&T cooperation of Member States/Associated States and Third Countries building on sharing efforts and resources. Lessons from existing bilateral schemes need to be learnt and to be expanded towards multilateral programmatic approaches of Member States/Associated States following the joint interest according to number 7 below. Here, not only funding programmes are addressed. Essential elements of such a framework are joint agenda setting, mobility aspects, intellectual property regulations and good governance in international S&T cooperation.

With this respect a better coherence and coordination of bilateral S&T agreements and EU S&T agreements should be achieved, including a continuous networking of national and EU science counsellors sharing information and good practice and - where appropriate - coordinating efforts.

The real challenge is the coordinated mobilisation of national S&T in the ERA addressing joint strategic interest of interested Member States/Associated States on a voluntary basis and aiming at mutual benefit with Third Countries. The European ERA-NET scheme and the most recently launched FP7 bi-regional INCO-NET scheme provided and will provide new momentum to set up a policy driven multilateral umbrella for S&T activities of Member States/Associated States and Third Countries.

As contribution to the up-coming mid-term evaluation of the RTD-Framework Programme the experience with the ERA-NET scheme should be carefully analysed based on the respective recent report of the 'Horvat-Group'. There seems to be room for improvement in order to adapt this coordination instrument addressed to Member States and Associated States to the specific case of cooperation with Third Countries. From today's experience, for optimising the ERA-NET scheme for the specific case of international cooperation the following CREST Working Groups' recommendations and open questions for further discussion can be summarised:

Operational issues	Political/strategic issues to be discussed
• Allow cooperation with Third Countries on equal footing; create *trust* (good practice: SEE-ERA.NET) and ensure reciprocity within joint actions.	• Combine the bottom-up approach for future ERA-NETs with some dedicated actions targeting coordinated funding schemes with the US, Japan and the neighbourhood region in order to fully ensure reciprocity within joint activities.

• Create flexibility through more openness to implement unforeseeable additional action and integrate new partners by allowing topping up of the budget (based on peer review).	• Better linking of bilateral and multilateral cooperation schemes.
• Offer smaller-scale top-up funding for ongoing thematic ERA-NETs to incentivise joint calls with additional partners from Third Countries	• Sustaining the achievements of Community actions (beyond 5 years) through dedicated instruments and structures (at MS/AS and Community level).
• Side effects (i.e. capacity building) can be very important – it is important to pick them up (linked to flexibility issue).	• Exploit other coordination instruments of MS/AS/Third Countries activities apart from joint call for S&T projects (i.e. in relation with infrastructures, JTP/Is, EIT or the JRC.
• A central administration body for offering central services to implement joint international programmes/calls of MS/AS (and Third Countries) fulfilling high quality standards, applying optimised validated tools and having a huge specific experience can be helpful. Here, a specific measure following art. 171 could be envisaged to establish a respective joint institution of MS.	• Ensuring consistency of MS and Community actions e.g. through active involvement of the EC in joint actions.
• Introduce a systematic procedure for external quality assurance and monitoring of ongoing ERA-NETs (to learn lessons, ensure high standards and improve individual performance).	
• Systematic involvement of science/technology counsellors of MS/AS + Community should be further elaborated – at least for some regions.	

Looking at the new instrument of the INCO-NETs, on the one hand side the INCO-NET consortia should be allowed to implement pressing new activities, which were initially not planned and to extend their networks to new partners (MS/AS), on the condition that they have proved to be efficient. On the other hand side, INCO-NETs should be not considered as "closed shops" but their activities should be open to interested relevant stakeholders from MS, AS and the respective partner region and their results should be widely spread[43]. Measures should be explored and enabled to keep alive the policy dialogues and the implementation of joint activities, which are kicked-off under the framework of INCO- or ERA-NETs, after the termination of such a project.

There needs to be a discussion on efficient management procedures and infrastructures for joint (programmatic) efforts of Member States/Associated States towards Third Countries. Community instruments should be used (ERA-NET plus, Art. 169, Art. 171). With this re-

[43] The implementation of new activities in the INCO-NET projects can be foreseen following FP7 contractual rule.

spect, particular attention should be given to explore the option of establishing a Joint Institution of the Member States in charge of the professional management of multilateral S&T calls for proposals of networks of Member States, Associates States and Third Countries following Art. 171/172 or under the ERA-NET-scheme (see text box below).

Food for thought for establishing a Joint Programme Management Institution Coordination of MS/AS S&T programmes towards Third Countries [44]

There is a clear trend of EU MS and AS for a closer cooperation at S&T policy level towards Third Countries. One of the most prominent examples is INTAS – the International Association for the Cooperation with Scientists from the Former Soviet Union[45].

In the very last years, at S&T programme level, the coordination process among the Member States and Associated States has been driven by the ERA-NET mechanism introduced through the 6th RTD Community Framework Programme. As examples, funding institutions from various Member States and Associated States are on their way to benefit from joint funding activities targeting at the cooperation with the Western Balkan Countries (SEE-ERA.NET), China (CO-REACH) and Latin America (EULANEST).

The most efficient way to explore the potential of coordination of international funding programmes of Member States institutions (and Third Countries institutions) in variable geometries is to establish a Joint Programme Management Institution (JPMI) delivering expertise and administrative services for the planning and implementation of joint calls for proposals following good practice gained from the INTAS activities or the most recent and ongoing ERA-NET activities.

In view of the implementation of ongoing international ERA-NETs and up-coming new international ERA-NET / ERA-NET plus activities it is most likely to have a growing demand for administrative services over the next years.

Services to be delivered
The services of JPMI could be manifold building on specific expertise and tools related to international programme management:

- consultancy for developing new 'joint funding concepts' for trans-national S&T cooperation at governmental level and as needed inter-governmental and non-governmental organisations
- drafting joint calls for proposals including guidelines for applicants
- launching calls and delivering consultancy services to interested parties (help desk)
- running an internet-based electronic submission system
- administering the evaluation of proposals incl. an international peer review process
- supporting the decision making process for project selection
- managing a 'common pot' of the funding parties, incl.
  - implementing the contract negotiations
  - administering the projects payments and monitoring the project
  - validation of project spending
  - reporting to the funding parties (outcome assessment and cost statements)
- consultancy for drafting international consortium agreements at project level

44 This paper is based on the outcome of a meeting in the French Ministry of Higher Education and Research on 11 June, 2007 attended by representatives of Austria, France, Germany, Greece, United Kingdom and INTAS. For further information please contact Jean-Luc Clement, Ministry of Higher Education and Research, Paris (jean-luc.clement@education.gouv.fr)

45 After almost 15 years of successful operation, the activities of INTAS will be terminated reacting to the changing environment for the S&T cooperation with Eastern Europe and Central Asia.

- internal quality control and evaluation

Implementation Process

Following the ERA concept and the strategic importance of its international dimension it seems to be an option to establish a joint institution of the Community following Article 171 for administering joint programmes of Member States, Associated States (and Third Countries) in variable geometries. The way to go is a quite long one and could be initiated through the ongoing discussion of the EC 'ERA Green Paper' of 4 April 2007.

In view of the timing and to initiate the implementation process, it is recommended to build a nucleus of such an institution through establishing JPMI as private, non-profit institution in one of the Member States with a core financing of a limited number of interested Member States ('Core Group') starting early 2008.

After being operational, the core financing should be toped up through administration fees charged to the future clients of JPMI in terms of funding parties of joint calls. Here, the financing institutions from the 'Core Group' of Member States should receive preferred conditions.

Building on the long lasting experience of INTAS, options should be explored to transfer tangible and intangible assets of INTAS to the new JPMI.

At a later stage – but as soon as possible – options should be explored to transfer the JPMI into a joint institution according to article 171 (as proposed above).

It is recommended that policy stakeholders from MS/AS and the EC:

xi. systematically extend ERAWATCH[46] to major Third Countries as well as increase its efficiency through linking it with existing information services in EU MS/AS and upcoming services to be developed under the INCO-NET scheme.

xii. increase transparency on opportunities for trans-national coordination of S&T policies and coordinated joint S&T activities within European and international organisations, programmes and initiatives. It is proposed to develop and update a 'Directory of European and International Organisations', describing their coordination instruments and listing contacts in terms of respective MS/EC participants.

xiii. develop a light but standardised system of indicators and databases through a coordinated effort to capture and assess the diverse policy measures related to the internationalisation of R&D in order to generate comparable statistics and evidence-based knowledge for decision-making processes (linked with recommendation *ii*.).

xiv. contribute to the mid-term evaluation of FP7 through establishing an Assessment Group on coordination instruments for S&T cooperation measures with Third Countries. Come-up with recommendations for optimising Community instruments and for assuring their sustainability.

46 ERAWATCH is a European web-based service that presents information on national and regional research policies, actors, organisations and programmes: http://cordis.europa.eu/erawatch. ERAWATCH is a joint initiative of the European Commission's Directorates General for Research and Joint Research Centre/Institute for Prospective Technological Studies (IPTS).

xv. analyse the interest of Member States/Associated States to establish a joint programme management institution for implementing multilateral funding activities targeting Third Countries. Together with the European Commission: Exploiting options of applying art. 171.

4. Implementing a proactive approach of the EU in international S&T initiatives through enhanced and coordinated participation in international organisations

Referring to the economic and scientific capacity of the ERA in particular in view of the ongoing Lisbon process, there is the potential to play a strategic role in international S&T initiatives implemented for instance at OECD or UN level. Here, building on European values and addressing common objectives of its Member States the global challenges should be addressed in first line, but additional European S&T agendas might be covered as well under the precondition, that the Member States share a common interest. Therefore, such a proactive role at Community level can only be built on harmonised approaches of the European Commission and the Member States requiring a strategic consultation process beforehand.

In this context a recent initiative of the G8 driven by Germany has to be highlighted, which aims to set up an international dialogue process to define research priorities for the next decade.

It is recommended that policy stakeholders from MS and the EC:

xvi. set-up a strategic dialogue between Member States and the Commission. This dialogue would identify and regularly update common priorities and relevant emerging topics, which are of joint interest for European initiatives in international organisations. If appropriate it could provide a process for ad-hoc consultation between Member States and the European Commission.

xvii. entrust the European Commission with the participation in international organisations complementing MS' participation - but not replacing them. If appropriate and legally possible, the Commission could represent the Community as such on the basis of positions previously agreed upon by the Member States on a case by case basis. The European Commission should report on their respective activities to the Member States.

5. Ensuring coherence and complementarity of European S&T policy towards developing countries and development policies at Member States and Community level

Like in ODA, a better alignment between the Member States and Associated States as regards 'research for development' activities with and in developing countries should be established, which are coherent to development goals. Here, there seems to be a particular need for coordination in and among Member States / Associated States in order to assure coherence, consistency and synergies and to avoid duplications of various measures in a target country. At first, a regular exchange of information on MS/AS activities should be introduced. In addition, good practices on how research for development can be realised in more structural ways should be exchanged and – where appropriate - joint strategies developed to ensure a sufficient research budget to service common priority issues. Last but not least, to be more efficient common ideas, approaches and initiatives should be communicated to other parties, including international donors, such as the World Bank, in a coordinative way.

Synergies between S&T policy and development policy towards developing countries should be exploited, acknowledging the fact that S&T is a major pillar for sustainable economic and so-

cial development. With this respect, building S&T capacities and contributing to implementing joint S&T activities should play a more self-evident and prominent role in the Member States' strategies to reach their ODA budget goals (e.g. 0,7% of GDP in 2015). I.e. knowledge transfer on structural issues regarding the implementation and/or upgrading of innovation and research systems should become an important issue in future ODA activities (e.g. institution building; structural capacity/S&T infrastructure building measures, establishment of models of real brain circulation etc.).

Another issue could be funding of dedicated activities of 'research on development' through national ODA budgets.

Complementing and supporting Member States' activities, the coherence of the respective Community instruments relevant for cooperation with Third Countries – here most prominently the Instruments of Foreign Assistance, the RTD Framework Programme and the Life Long Learning Programme - need to be strengthened, as well.

It is recommended that policy stakeholders from MS and the EC:

xviii. increase transparency through establishing a data base of ongoing and past activities of 'research for development' at MS/AS and Community level (emphasis on DCEC and ENP instruments);

xix. work-out a policy document on 'S&T and development policies' incl.
- synergies of S&T and development policy objectives towards Africa, South-East Asia, Latin America and the Caribbean
- recommendations on how to link instruments of S&T policy and development policy at MS' and Community level in order to exploit synergies
- criteria and respective proposals for joint activities of MS/AS
- scenarios, how to use ODA money for the upgrading of S&T structures in developing countries (through capacity building, institution building and research for development measures).

Here, the upcoming activities within the bi-regional dialogues implemented through the INCO-NET scheme should be considered.

xx. coordinate S&T related activities towards developing countries on MS/AS and Community level through establishing a 'Global INCO-NET' as a dialogue forum of respective stakeholders involving wherever appropriate stakeholders from developing countries.

6. Ensuring harmonised and consistent activities of Member States and the European Commission

One of the present weaknesses of the ERA is its still existing fragmentation in many respects. This does also concern the European Commission and the Member States. To overcome this threat and summarising previous recommendations, mechanisms should be installed:

- to ensure consistency and synergies of S&T agreements of the Community and the Member States
- to build a living network of the EU Delegations abroad and Member States embassies
- to identify areas of clear benefit of coordination between Member States and the European Commission in international organisations including implementation measures for the decisions of international organisations building both on Member States' and Community instruments.

It is recommended that policy stakeholders from MS and the EC:

xxi. establish an ad-hoc Expert Group of Member States and Commission Service to:
- analyse the relevance, practicability and the impact of present S&T agreements at MS and Community level and the need for a legal frame for S&T cooperation (in view of EU interest, barriers and threats for cooperation with Third Countries to be identified according to recommendation *vii/viii*)
- define the future complementary role and content of Community S&T agreements in relation to MS S&T agreements with Third Countries.

xxii. make optimum use of the established consultations mechanism between the Member States and the Commission in the negotiation phase of new Community S&T agreements and set-up a mechanism for an enhanced information exchange and coordination between Member States and the Commission on implementing ongoing S&T agreements.

xxiii. set-up Terms of Reference for local networks of EC and MS science counsellors in Third Countries organised with secretarial support of the EU Delegation aiming at sharing information and good practice as well coordinating efforts (if appropriate).

In order to enable the implementation of the proposed actions and to monitor respective upcoming activities, the necessary structural setting for needs to be provided. With this regard it is proposed to:

7. Establish a sustainable forum for a strategic dialogue between Member States, Associated States and the European Commission on internationalisation of R&D

The present CREST Working Group on Internationalisation of R&D demonstrates the need for and the benefits from a continuous dialogue among the Member States and Associated States involving the European Commission on various aspects of national and Community policies on the internationalisation of R&D. One important aspect deals with the identification of areas for enhanced coordination of MS policies towards Third Countries, which is to a high extent supported by Community instruments. An additional question not dealt with by the CREST Working Group, concerns the development of a Community strategy and respective implementation instruments for the international dimension of the European Research Area, going even beyond the questions raised in the present ERA Green Paper 'The European Research Area: New Perspectives'.

Against this background it is recommended to establish a strategic forum on international cooperation with high level representatives from the Member States, Associated States and the European Commission with an adequate support. It should be considered to invite major intergovernmental European S&T institutions (like CERN, ESA, EMBL) and Umbrella Organisations operating at European level (like European Science Foundation, European University Association, European Intergovernmental Research Organisation´s Forum / EITRO Forum) to join the dialogue.

The mandate of the strategic forum should cover,

- to define and regularly adapt specific common objectives of the Member States and respective priorities for Community action for the S&T cooperation with Third Countries,

- to monitor the implementation of respective activities of international cooperation at Community level with respect to consistent and coordinated approaches of Member States and Commission measures,
- to propose actions to the Member States and the European Commission,
- to exchange information on strategic issues of S&T cooperation towards Third Countries at MS/AS and Community level.

Such a dialogue forum might be established either by CREST or by the Council.

It is recommended that policy stakeholders from MS, AS and the EC:

xxiv. set-up a strategy forum on international cooperation with high-level representatives of the Member States, Associated States and the European Commission in an appropriate form (i.e. by CREST) for developing, implementing and monitoring the international dimension of the ERA with adequate support.

6. Outlook

Responding to the opportunities and challenges of globalisation, internationalisation of R&D is becoming an issue of further growing importance at policy level of MS/AS. Against this background, the CREST Working Group discussions lead to the following lessons learnt as regards the prospects of mutual learning as well as to consistent or coordinated activities of MS/AS:

1. Addressing particular needs of the MS/AS, ***mutual learning*** offers further benefits through:
   - o in-depth exchange of information and experiences on national strategies and implementation measures incl. criteria and tools for its impact assessment, including
   - o enforcing joint discussions on enhanced national policy measures across various policy fields (incl. higher education, innovation, foreign policy, development policy etc.)
   - o allowing in-depth discussions on criteria and instruments for coordination activities incl. Community instruments
2. The reflections of the WG demonstrate the needs for particular ***joint action*** of MS/AS and the Commission to strengthening the international dimension of the ERA through:
   - o setting up a wider Community strategy for international S&T cooperation embedded in other Community policies as part of the renewed Lisbon strategy building on common interests of the MS/AS and common European values
   - o offering effective and efficient Community instruments for its implementation leaving room for joint initiatives of a group of MS/AS in variable geometries
   - o actively involving strategic partner countries like USA, Japan, Russia, China to set-up joint strategies for mutual benefit based as much as possible on reciprocity
   - o identifying the future role of the Community in international initiatives and organisations on global scale and taking necessary steps for its implementation in order to allow "speaking with one voice" as regards issues of particular European interest and to address global challenges.

Although the report summarises 'food for thought' for gaining added value from internationalisation of R&D both at MS/AS and Community level, a number of questions require more in-depth discussions, among them:

- o What are the key elements of a broader globalisation strategy bridging various policy fields at national and Community level?
  What are consistent and complementary policy measures to implement this strategy?
  Note: Those measures should include particular links between S&T policy and development policy targeting Third Countries.
- o How to link the numerous and further developing decentralised strategic activities of science organisations, S&T institutions, innovative enterprises with centralised policy approaches at and Community level?
- o How does an appropriate (legal) framework look like to raise the full potential of international cooperation for MS/AS S&T institutions and innovative enterprises to be built on complementary rules and regulations at national and Community level?

How to protect European intellectual property allowing at the same time European openness for international cooperation including open access to scientific data?

- What are success factors of strategies on internationalisation of R&D of major European competitors?
  What are the implications for the ERA balancing cooperation and competition with highly industrialised and emerging economies?
- How to most efficiently gain information on S&T policies and on S&T activities in priority partner countries to provide a knowledge base for policy development?

Addressing the activities of the CREST OMC Working Group it is proposed that Member States, Associated States and the European Commission consider the Working Group Report and its recommendations for further developing R&D internationalisation strategies both on national and on Community level and to draw conclusions for appropriate policy action including amongst others:

- develop a wider EU strategy on international S&T cooperation, which is embedded in other Community policies (to be proposed by the European Commission)
- provide an appropriate umbrella to proceed with and deepen the strategic discussion on internationalisation of R&D
- arrange dedicated discussion on key policy issues including those questions, which are mentioned above
- prepare a better and transparent analytical ground for political decision making at MS/AS and Community level.

Along that line, MS/AS and the European Commission should jointly take necessary action to further analyse the setting-up of a ***European strategy forum on internationalisation of R&D*** for developing, implementing and monitoring the international dimension of the ERA on a regular basis, which is built on coherent policy measures in terms of:

- autonomous activities of Member States towards Third Countries to strengthen national S&T activities preparing the ground for the ERA
- joint activities of a group of Member States in variable geometries towards Third Countries addressing common interest
- complementary Community measures of particular added value.

Existing instruments on Community level such as the EU RTD Framework Programme should be applied as much as possible to further develop international S&T cooperation.

The members of the present CREST Working Group are ready to contribute to further activities at Community level.

List of Abbreviations

ADA	Austrian Development Agency
AMCOST	African Ministerial Council on Science and Technology
AS	Associated States *(States associated to the European RTD Framework Programme)*
ASEAN	Association of Southeast Asian Nations
ASO	Austrian Science Office
AvH	Alexander von Humboldt Foundation (Germany)
BMBF	Federal Ministry of Education and Research (Germany)
BRIC	Brazil, Russia, India, China
BRICS	Brazil, Russia, India, China, South Africa
BSEC	Black Sea Economic Cooperation
CA	Coordination Action
CAS	Chinese Academy of Science
CERN	European Organisation for Nuclear Research
CIP	Competitiveness and Innovation Framework Programme
CMU	Carnegie Mellon University
COST	European Cooperation in the Field of Scientific and Technical Research (*Coopération européenne dans le domaine de la recherche scientifique et technique*)
CREST	Scientific and Technology Research Committee (*Comité de Recherche Scientifique et Technique*)
CSETs	Centres for Science, Engineering and Technology (Ireland)
CZELO	Czech Liaison Office for RTD
DAAD	German Academic Exchange Service (*Deutscher Akademischer Austauschdienst*)
DCEC	Development Cooperation and Economic Cooperation
DCECI	Development Cooperation and Economic Cooperation Instrument
DFG	Deutsche Forschungsgemeinschaft
DG	Directorate General
EARTO	European Association of Research and Technology Organisations
EC	European Community
EDCTP	European and Developing Countries Clinical Trials Partnership
EEA	European Economic Area
EIRMA	European Industrial Research Management Association
EISCAT	European Incoherent SCATter
EMBL	European Molecular Biology Laboratory
ENP	European Neighbourhood Policy
ENPI	European Neighbourhood Policy Instruments
ERA	European Research Area
ESA	European Space Agency
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESRF	European Synchrotron Radiation Facility
EU	European Union
EUA	European University Association

EUREKA	European Research Coordination Agency
EVD	Agency for International Business and Cooperation (The Netherlands)
FAO	Food and Agriculture Organisation
FDI	Foreign direct investment
FECC	Finnish Environmental Cluster for China
FinChi	Finnish-Chinese Innovation Centre
FP	European Framework Programme for Research, Technological Development and Demonstration
G8	Germany, France, Italy, Japan, Canada, Russia, US, UK
GPA	Government Procurement Agreement (WTO)
JINR	Joint Institute for Nuclear Research (Russia)
JPMI	Joint Programme Management Institution
JRC	Joint Research Centre
GDP	Gross domestic product
GSIF	Global Science and Innovation Forum
IAEA	International Atomic Energy Agency
ICES	Institute for Computational Engineering and Sciences
ICT	Information and Communications Technology
ICTI	Information and Communication Technologies Institute
INTAS	International Association for the promotion of cooperation with scientists from the New Independent States of the former Soviet Union
IP	Intellectual property
IPR	Intellectual property rights
IPSWaT	International Postgraduate Studies in Water Technologies
IRD	International Research Dialogue
ISTC	International Science and Technology Centre (Russia)
JTI	Joint Technology Initiative
LLL	Lifelong learning
LoI	Letter of Intent
MAE	Ministry of Foreign Affairs (France)
MCTES	Ministry of Science, Technology and Higher Education (Portugal)
MDGs	Millennium Development Goals
Mercosur	Southern Common Market (*Mercado Común del Sur*)
MEYS	Ministry of Education, Youth and Sports (Czech Republic)
MIT	Massachusetts Institute of Technology
MNC	Multinational company
MNE	Multinational enterprise
MoCo	Monitoring Committee for the Mediterranean Countries
MoU	Memorandum of Understanding
MS	Member States
MSER	Ministry of Higher Education and Research (France)
NASR	National Authority for Scientific Research (Romania)
NCO	Czech National Contact Organisation
NDRC	National Development Reform Commission
NEPAD	New Partnership for Africa's Development
NRP	National reform programmes
NSFC	National Natural Science Foundation (China)
ODA	Official Development Assistance

OECD	Organisation for Economic Cooperation and Development
OMC	Open Method of Coordination
R&D	Research and Development
R&I	Research and Innovation
RTD	Research and Technological Development
S&T	Science and Technology
SCST	Supreme Council for Science and Technology (Turkey)
SICA	Specific International Cooperation Action
SME	Small and medium sized enterprise
SOE	State-owned enterprise
SSA	Specific Support Action
STCU	Science and Technology Centre in the Ukraine
STC	Science and Technology Cooperation
STI	Science, Technology and Industry
TACC	Texas Advanced Computer Center
TCM	Traditional Chinese Medicine
Tekes	Finnish Funding Agency for Technology and Innovation
TP	Technology Platform
TÜBITAK	Scientific and Technological Research Council (Turkey)
UKTI	UK Trade & Investment
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organisation
WAPI	Wireless local area networks
WG	Working Group
WHO	World Health Organisation
WIPO	World Intellectual Property Organisation

Annexes

(a) Questionnaire on national policy measures for the internationalisation of S&T towards third countries outside the EU

(b) Questionnaire on countries' cooperation in science and technology with China

(c) Terms of Reference for the 'Analysis of emerging economies/upcoming competitors'

(d) Lessons learnt from the S&T cooperation of Member States/Associated States with present and future international competitors: Pilot case China

(e) Reflections of the CREST Working Groups on the Green Paper 'The European Research Area: New Perspectives'

Annex (a): Questionnaire on national policy measures for the internationalisation of R&D towards third countries outside the EU

Introduction

Based on a decision of CREST (The European Scientific and Technical Research Committee), practicing the open method of coordination a CREST Working Group was set up by Member States and Associated States in order to facilitate a mutual learning process among them on the national policy approaches to the internationalisation of S&T towards Third Countries outside the EU/Associated States.

Here, internationalisation is defined as a proactive national response to the challenges of the globalisation of S&T in order to make optimum use of worldwide knowledge and scientific resources and to reduce possible disadvantages like brain drain, IPR misuse etc..

This Working Group will provide contributions to future national policy making and will prepare the ground for coherent and coordinated policy approaches of Member States and Associated States (Turkey, Iceland, Israel, Liechtenstein, Norway and Switzerland) towards Third Countries (all other countries).

This **Questionnaire** is developed in order to get an overview of the most important policy measures of the national administrations. Building on the analysis of the responded questionnaires, in-depth looks will be taken to identify good practice, common objectives and open questions, which require further discussion.

This questionnaire consists of four major sections:

Part 1: Concrete policy measures towards the internationalisation of R&D
Part 2: Comprehensive national strategies and embedding of R&D policies in the broader policies towards internationalisation
Part 3: Trans-national coordination of R&D policies towards Third Countries and strategies towards international organisations
Part 4: Monitoring and evaluation of international activities

We would welcome if relevant policy papers or other documents are added to the responses.

In case of any questions please contact:

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The completed questionnaire should be submitted **until March 30, 2007** in electronic form to:

Peter Teirlinck **peter.teirlinck@belspo.be** **and** Jan Nill **jan.nill@ec.europa.eu**

This Questionnaire was filled in by:

name: and

organisation:

phone:

email:

In case of additional questions please contact:

☐ myself (i.e. the first person mentioned above)

☐ name:

organisation

phone:

email:

Part 1: Concrete policy measures towards the internationalisation of S&T

The process of internationalisation of S&T materialises through four important areas. These include:

International collaboration in S&T of institutions (universities, public research institutes and industries) from more than one country

International in- and outward mobility of individual scientists aiming at carrier development and human capacity building

The international exploitation of research and the issue of knowledge Protection versus dissemination

Foreign direct investments in R&D i.e. the inward and outward investments in R&D systems

For each of these topics some concrete questions are formulated below. Please answer these from the perspective of policies specific to your country and in relation to Third Countries (i.e. outside EU and Associated States (AS)).

1.1 International S&T collaboration of public and private institutions

1.1.1 Do national policy measures exist to enhance collaboration in S&T with (public or private) partners in Third Countries?

☐ Yes
☐ No

If 'Yes',

1.1.1.1 Which of the following measures exist?
Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	**Funding for projects with S&T partners in Third Countries, through:**	
☐	participation of foreign institutions in national S&T programmes without funding	
☐	participation of foreign institutions in national S&T programmes with funding (opening of national funding schemes)	
☐	small scale funding for stimulating international S&T co-operation (mobility, …)	
☐	other measures:	
☐		
☐	Fiscal incentives for projects with S&T partners from Third Countries	

☐ **Promotion of your national S&T in Third Countries, through:**

- ☐ Embassies
- ☐ Dedicated Agency(ies)
- ☐ Foreign Branches of national S&T organisations/institutions
- ☐ Promotion/Research Marketing Campaigns
- ☐ Other measures:
- ☐

☐ **Technical advice for S&T collaboration**

☐ **Support to find partners in Third Countries**

☐ **Joint funding of the establishment of large scale S&T infrastructure with partners in Third Countries**

☐ **Joint funding of running costs of large scale S&T infrastructure with partners in Third Countries**

☐ **Other measures:**

Which of the existing measures do you consider to be most successful? Please give a brief explanation:

Measure	**Why do you consider it to be successful?**

1.1.1.2 Please classify Third Partner Countries for S&T cooperation?

Priority countries	**S&T agreement**
1.	☐
…	

Non-priority countries	**S&T agreement**
1.	☐
…	

1.1.1.3 Please describe the procedure to select partner countries:

1.1.1.4 What are the three major criteria to select partner countries?

If relevant, please indicate priority S&T domains for major partner countries and respective major cooperation measures (see 1.1.1.1) in the matrix below
(☐ Not relevant)

	Country 1	Country 2	Country 3
Country			
Major priority S&T domains per priority partner country	1. 2. 3.	1. 2. 3.	1. 2. 3.
Major three measures per priority partner country	1. 2. 3.	1. 2. 3.	1. 2. 3.

If relevant: How does your government collect systematic information on S&T in Third Countries? (☐ Not relevant)

Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	**Measure**	**Select Priority**
☐	National embassies in Third Countries	
☐	National liaison offices in the following Third Countries	
☐	Affiliates of national R&D institutions in the following Third Countries	
☐	Systematic reviews/studies	
☐	Regular bilateral workshops/conferences	
☐	Systematic analysis of project reports from bilateral programmes with Third Countries	
☐	Systematic analysis of participation of Third Countries in European/international programmes	
☐	In cooperation with other European governments	

Other measures:

☐

☐

Room for comments:

1.1.1.7 Are there differences (referring to subquestions 1.1.1.1 till 1.1.1.6) in the policies for cooperation with on the one hand small and medium sized enterprises and on the other hand large companies?

☐ Yes
☐ No

If 'Yes', please specify

1.1.1.8 Are there differences (referring to subquestions 1.1.1.1 till 1.1.1.6) in the policies for cooperation with private and non public research organisations (including universities) on the one hand and industries on the other hand?

☐ Yes
☐ No

If 'Yes', please specify

1.1.2 Are there different policy measures for S&T partners (public or private) within EU (incl. AS), and those outside EU?

☐ Yes
☐ No

If 'Yes', please explain (if relevant you could use the different measures listed in question 1.1.1.1):

1.1.3 How do Community instruments (mainly the Framework Programmes) affect your respective policy measures towards S&T cooperation with Third Countries?

☐ They are the main frame for collaboration with Third Countries
☐ They complement national policy initiatives towards Third Countries
☐ They are not considered an essential part of the national strategy towards collaboration with Third Countries
☐ Others:

Please estimate the total share of the Framework Programme's contribution to the S&T cooperation of your research communities with Third Countries in % of the total amount spent for your research communities for international Third Country cooperation:

☐ below 25%
☐ between 25% and 50%
☐ between 51% and 75%
☐ above 75%

1.1.5. Please estimate the relevance of S&T cooperation with Third Countries compared with S&T cooperation with EU partner countries

	more relevant than EU partner countries	equally relevant	less relevant	far less relevant
USA/Japan	☐	☐	☐	☐
Other industrialised Third Countries	☐	☐	☐	☐
Developing Third Countries	☐	☐	☐	☐
Less developed countries	☐	☐	☐	☐

Room for comments:

Have there been any major changes in policy measures towards collaboration in S&T with Third Countries during the last years?

☐ No
☐ Yes

Major Changes:

Are there new initiatives to be envisaged

☐ No
☐ Yes

New initiatives:

1.2 International in- and outward mobility of individual scientists

1.2.1 Do national policy measures exist to enhance mobility of researchers and S&T students with Third Countries, which are implemented through public funds?
☐ Yes
☐ No

If 'No',

1.2.1.1 Why not?

If 'Yes',

1.2.1.2 Which of the following types of mobility are envisaged with respect to Third Countries?

Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Increasing the attraction of foreign students	
☐	Increasing the attraction of foreign researchers	
☐	Increasing the retention of 'national' researchers working abroad	
☐	Increasing the international circulation of national researchers	
☐	Increasing the international connection of national researchers	
Other measures		
☐		

1.2.1.3 Which of the following policy measures are applied with respect to Third Countries (by type of mobility)? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select priority
☐	Preferential immigration legislation for foreign researchers	
☐	Provision of spousal work visas	
☐	Decreasing administrative burden to obtain working permits	
☐	Reduction of income taxation	
☐	Provision of incoming fellowships	
☐	Provision of outgoing fellowships	
☐	Enhanced accreditation of qualifications	
☐	Raising attraction of universities and research institutes	
☐	Enhancement of individual mobility under S&T agreements	
☐	Measures towards the internationalisation of the national research community (including e.g. multilinguistic research environments)	
☐	Specific measures towards 'star' scientists	
☐	Provision of return programmes	
Other Measures:		
☐		

Which of the existing measures applied towards Third Countries do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

1.2.2 Are there different policy measures for mobility of researchers/ S&T students within EU (incl. AS) and outside EU?

☐ Yes
☐ No

If 'Yes', please explain (if relevant you could use the different measures listed in question 1.2.1.2):

1.2.3 How do Community instruments (programmes for international mobility of researchers and S&T students) affect your respective policy measures towards Third Countries?

☐ They are the main frame for international mobility of researchers
☐ They complement national policy initiatives
☐ They are not considered an essential part of the national strategy towards international mobility of researchers and S&T students
☐ Others:

Have there been any major changes in policy measures for mobility of researchers towards Third Countries during the last years?

☐ No
☐ Yes

Major Changes:

Are there new initiatives to be envisaged?

☐ No
☐ Yes:

New initiatives:

1.3 The internationalisation of the exploitation of research

There are cases, where governments actively support the international transfer and the utilisation abroad of intellectual property and other S&T results of their S&T institutions on the basis of common interest with foreign partner institutions. Also, policies can exist to exploit at the national base the results of research generated abroad.

1.3.1 In general, how could you describe your government's attitude towards the international exploitation of research and especially the de-linking of the place where the commercial exploitation of the outcomes of R&D takes place with the place where the R&D is performed?

☐ Open (i.e. in favour of dissemination of knowledge towards other countries)
☐ Closed (i.e. in favour of protection of nationally produced knowledge)
☐ Balanced (between dissemination and protection)

☐ I have no clear opinion

Room for comments:

1.3.2 Besides multilateral agreements, do policy measures exist to regulate the exploitation of knowledge in Third Countries produced in your country (including protection – intellectual property rights - of domestically produced knowledge)?

☐ Yes
☐ No

If 'Yes', which measures exist? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select priority
☐	Bilateral agreements with Third Countries for protection of intellectual property	
☐	Bilateral agreements for technology licensing	
☐	Specific measures to promote the protection of knowledge generated by your universities (e.g. by facilitating patenting processes)	
☐	Specific measures to promote the protection of knowledge generated by your research institutes (e.g. by facilitating patenting processes)	
☐	Specific measures to promote the protection of knowledge generated by your SMEs	

Other measures to protect the knowledge base of universities, research institutes and SMEs:

☐

☐

1.3.3 Do policy measures exist to enhance the national exploitation of knowledge produced in Third Countries?

☐ Yes
☐ No

If 'Yes', which measures exist?

Which of the existing measures referred to in 1.3.2 an 1.3.3 do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

1.3.4 Are there different policy measures for the international exploitation of knowledge within EU (incl. AS) and outside EU?

☐ Yes
☐ No

If 'Yes', please explain (if relevant, you could use the different measures listed in question 1.3.2):

Have there been major changes in policy measures for the exploitation of national research in Third Countries during the last years?

☐ No
☐ Yes:

Major Changes:

Have there been major changes in policy measures for stimulating the exploitation of research developed in Third Countries in your own country during the last years?

☐ No
☐ Yes:

Major Changes:

Are there new initiatives to be envisaged (referring to questions 1.3.5 and 1.3.6)?

☐ No
☐ Yes:

New initiatives:

1.4 Foreign direct investments in R&D

On the one hand this question relates to policies of your government that target investments of foreign institutions (mainly multinational enterprises) in R&D activities in your country (inward FDI). On the other hand policy measures are concerned, that aim to benefit from investments of your country or private sector in R&D activities in Third Countries (outward FDI).

1.4.1 Are there any specific measures that support the establishment of new R&D activities from Third Countries in your country through foreign direct investment?

☐ Yes
☐ No

If 'No',

1.4.1.1 Why not?

If 'Yes',

1.4.1.2 Which of the following measures exist? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Direct financial support	
☐	Fiscal incentives (tax breaks, R&D tax credits …)	
☐	Administrative support	
☐	Provision of infrastructure (including premises)	
☐	Provision of subsidised space in Science and Technology Parks	
☐	Public procurement	
☐	Active recruitment of foreign firms and/or universities	
☐	Promotion of national strengths abroad	
☐	Cluster policies towards attraction of FDI in R&D	

Other measures:

☐

Which of the existing measures do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

1.4.2 Is there any positive (e.g. more advantageous fiscal regime or more direct R&D funding) or negative (e.g. exclusion of R&D funding or of specific research programmes) discrimination in place for R&D performed by affiliates owned by Third Countries compared to R&D performed by 'domestic' institutions?

☐ Positive discrimination
☐ Negative discrimination
☐ No discrimination

If discrimination exists, please clarify:

1.4.3 Are there policy instruments to profit from spillovers from FDI in R&D (both inward and outward)?

☐ Yes
☐ No

If 'Yes', which of the following measures exist?

☐ Policy incentives to enhance the embeddedness of inward FDI in R&D in your country in the national environment (e.g. by means of stimuli to cooperate with local research institutes/firms, identification of suitable local suppliers for foreign R&D players; identification of appropriate partners and projects, local capacity and capability building in relation to FDI in R&D...)
☐ Policy incentives to stimulate knowledge feedback from outward FDI in R&D in a Third Country into the national innovation system of your country
☐ Other

If you ticked one of these options, please explain:

Have there been major changes in policy measures towards FDI in R&D during the last decade?
☐ No
☐ Yes:

Major Changes:

Are there new initiatives to be envisaged?
☐ No
☐ Yes:

New initiatives:

Part 2: Comprehensive national strategies and embedding of S&T policies in the broader policies towards internationalisation

Some countries have recently introduced wider policy strategies towards globalisation in general, or even more specific strategies towards the internationalisation of S&T. These strategies integrate various policies into a coherent and coordinated national approach.
Other countries have indicated that such strategies are currently under development.

2.1 Does a comprehensive national strategy on internationalisation of S&T already exist or is under development?

☐ Yes, a specific national strategy on internationalisation of S&T already exists
☐ Yes, a national strategy on internationalisation of S&T already exists, but it is part of a broader strategy on globalisation
☐ Yes, a specific national strategy on internationalisation of S&T is under development
☐ Yes, a national strategy on internationalisation of S&T is under development as a part of a broader strategy on globalisation
☐ No

If 'No',

2.1.1 Why not?

If Yes

2.1.2 Have there been any major changes in the national strategy recently?

☐ No
☐ Yes

Major Changes:

2.1.3 Are there new initiatives to be envisaged?

☐ No
☐ Yes

New initiatives:

2.1.4 What are the major national strategic objectives of internationalisation of S&T with Third Countries?

Which other policies do influence your policy on internationalisation of S&T to-wards Third Countries? Please indicate the priority using 1 (low priority) up to 3 (high priority)?

Select	**Measure**	**Select Priority**
☐	Economic and Labour-market policy	
☐	Foreign Policy	
☐	Development Policy	
☐	Regional Policy	
☐	Justice and Internal Affairs	
☐	Environmental Policy	

Other Policies :

☐
☐

2.1.6 Which institution coordinates the development of the national strategy for the internationalisation of S&T?

2.1.7 How did your government develop a national strategy?

2.1.8 Which stakeholders are involved in the development of the national strategy for the internationalisation of S&T? Please indicate the priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Ministries	
☐	Research Funding Agencies	
☐	Universities or University Associations	
☐	Non-university research organisations or associations	
☐	S&T Councils and other R&D Advisory bodies	
☐	Business Organisations	
Others:		
☐		
☐		

Which stakeholders are implementing the national strategy for the internationalisation of S&T?

☐ Ministries
☐ Public Agencies
☐ Science Organisations
☐ Research Councils
☐ Business Organisations
☐ Others:

2.2 How do you assure coordination and commitment of the various stakeholders from the S&T community, industries and policy making?

If relevant due to a decentralised (i.e. federal) system:
How do you assure coordination among the national/federal government and regional political stakeholders? ☐ not relevant

Room for comments:

Part 3: Trans-national coordination of R&D policies towards Third Countries and strategies towards international organisations

3a Coordination of R&D policies towards Third Countries between EU-MS/AS
Section 3a aims to get an insight in the mechanisms of joint activities of several MS/AS to coordinate their strategies/measures with or towards Third Countries.

3.1 Are there mechanisms applied by your national administration for a trans-national coordination of national policies for an internationalisation of S&T towards Third Countries? (Remark: The participation in the present CREST OMC-Working Group on Internationalisation is not considered, here.)

☐ Yes
☐ No

If 'No',

3.1.1 Why not?

If 'Yes',

3.1.2 What are the major objectives of policy coordination in the field of S&T between EU-MS/AS towards Third Countries?

3.1.3 Which of the following measures are applied? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	bilateral consultations with EU-MS/AS on joint activities in Third Countries on a regular basis, with the following countries:	
☐	bilateral consultations with EU-MS/AS on joint activities in Third Countries on a sporadic basis	
☐	regular networking of the science counsellors at your Embassies with EU colleagues in the following Third Countries:	
☐	participation in Community instruments supporting the coordination of EU-Member States activities towards international co-operation with Third Countries(ERA-NETs, SSA)	
Other measures:		
☐		

Which of the existing measures do you consider to be most successful? Please give a brief explanation:

Measure	**Why do you consider it to be successful?**

3.2 What are the major changes in policy measures for trans-national coordination of R&D policies towards Third Countries during the last years?

Major Changes:

How strong is the need from your side for a coordination of S&T policies and activities of MS/AS towards Third Countries?

☐ very strong ☐ strong ☐ indifferent ☐ weak ☐ no need

3.4. In case of future coordination mechanisms, is there any initiative envisaged or proposed by your side?

New initiatives:

3.5 What are the most important barriers for a trans-national coordination?

☐ There are no barriers

☐ Major barriers are:

3b Strategies towards international organisations

Section 3b addresses proactive approaches of MS/AS to the participation in S&T relevant international organisations outside the EU.

3.6 Which non-European international bodies are of utmost importance for S&T policy in your country? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	OECD (CSTP/TIP)	
☐	G8/Carnegie-Group	
☐	UNESCO	
☐	UNCTAD	
☐	IAEA	
☐	FAO	
☐	UNIDO	
Others:		
☐		
☐		

3.7 Which of the following measures does your administration apply in order to actively participate in S&T relevance international bodies? Please indicate their priority using 1 (low priority) up to 3 (high priority)

Select	Measure	Select Priority
☐	Active delegation of civil servants or national experts in governing boards, management councils, advisory groups etc.	
☐	Awareness raising, promotion and information dissemination of job offerings	
☐	Preparation and practical assistance to experts from your country, which will take over jobs in international organisations	
☐	Using the expertise of national experts returning from international organisations i.e. through job offerings	
☐	Secondment of national experts (paid by national funds)	
☐	Active communication and cooperation of your administration with experts from your country working in international organisations	
Others:		
☐		
☐		

3.8 Are there any measures of your administration to coordinate your S&T related activities in international bodies with other countries?

☐ Yes
☐ No

If 'Yes', which ones:

3.9 Which of the existing measures referred to in 3.7 and 3.8 do you consider to be most successful? Please give a brief explanation:

Measure	Why do you consider it to be successful?

3.10 Have there been major changes in policy measures for a proactive participation in international organisations during the last years?

☐ No
☐ Yes

Major Changes:

3.11 Are new initiatives to be envisaged?

☐ No
☐ Yes

New initiatives:

Part 4: Monitoring and evaluation of international S&T activities towards Third Countries

There is a clear trend towards systematic monitoring of policy measures in most countries. However, the evaluation of international instruments has its own characteristics and might be different from evaluation of national instruments.

4.1 Do you monitor and/or evaluate the implementation of national policy measures supporting the internationalisation of S&T?

☐ Yes
☐ No

If 'No',

4.1.1 Why not?

If 'Yes',

4.1.2 Which aspects of the policy measures do you evaluate?

4.1.3 What type of evaluation method do you apply including main indicators and tools?

4.1.4 What type of evaluators is involved?

☐ External evaluation panel consisting of national experts, only
☐ External evaluation panel involving international experts
☐ Independent contracted organisation
☐ Internal evaluation panel/unit
☐ Others:

4.1.5 Are there monitoring/evaluation reports available?

☐ Yes (If 'Yes', please enclose a summary in English, German or French)
☐ No

4.2 If you do not monitor and/or evaluate the implementation of national policy measures supporting the internationalisation of S&T, do you plan to establish such a monitoring/evaluation?

☐ Yes
☐ No

Annex (b): Questionnaire on countries' cooperation in science and technology with China

Introduction

Based on a decision of CREST (The European Scientific and Technical Research Committee), practicing the open method of coordination a Working Group was set up by Member States and Associated States in order to facilitate a mutual learning process among them on the national policy approaches to the internationalisation of S&T towards Third Countries outside the EU/Associated States.

Here, internationalisation is defined as a proactive national response to the challenges of the globalisation of S&T in order to make optimum use of worldwide knowledge and scientific resources and to reduce possible disadvantages like brain drain, IPR misuse etc..

This Working Group will provide contributions to future national policy making and will prepare the ground for coherent and coordinated policy approaches of Member States and Associated States (Turkey, Iceland, Israel, Liechtenstein, Norway and Switzerland) towards Third Countries (all other countries).

This **Questionnaire** is developed in order to get an overview of Member States' and Associated States' science and technology policies and experiences with regard to China. Building on the analysis of the responded questionnaires, in-depth looks will be taken to identify good practice, common objectives and open questions, which require further discussion.

We would welcome if relevant policy papers or other documents are added to the responses.

In case of questions please contact:

Sylvia Schwaag Serger
Sylvia.schwaagserger@itps.se

The completed questionnaire should be submitted **by June 29, 2007** in electronic form to:

Sylvia Schwaag Serger (Sylvia.schwaagserger@itps.se) and Jörn Sonnenburg (joern.sonnenburg@dlr.de)

We thank you very much for your cooperation.

This Questionnaire was filled in by:

name: and

organisation:

phone:

email:

In case of additional questions please contact:

☐ myself (i.e. the first person mentioned above)

☐ name:

organisation

phone:

email:

Does your government promote cooperation in science, technology, research and/or innovation with China?

☐ Yes

☐ No

If yes,

a) Is there a cooperation agreement and if so when was it signed?

☐ No

☐ Yesdate when the agreement was signed:

date when it was renewed (if applicable)

Chinese partner institution/organisation:

Is the agreement active (planned activities are being carried out)?

☐ No

☐ Yes

b) Please describe the major objectives of your governments S&T co-operation with China:

c) What are the main instruments of your government to promote and support S&T co-operation with China (incl. mobility, project support, framework setting)?

d) What are the main thematic priorities of your government for S&T cooperation with China?

e) Is there a general tendency of your government

☐ to reconsider S&T cooperation with China?

☐ to enhance S&T cooperation with China?

☐ to reduce S&T cooperation with China?

f) Have there been any strategic initiatives by your government to strengthen the S&T cooperation with China within the past 3 years?

☐ Yes

☐ No

If yes, please briefly describe them:

g) Are there any strategic initiatives of your government planned to strengthen the S&T cooperation with China within the coming five years?

☐ Yes

☐ No

If yes, please briefly describe the state of discussion:

f) Please add any further comments you might have below:

Does your government have a general China strategy / Asia strategy?

☐ Yes

☐ No

If yes, does it include S&T cooperation?
☐ Yes

☐ No

Please add any further comments you might have below:

Do you have institutions/actors located in China with the purpose of promoting scientific/academic cooperation, including education cooperation/exchange, with China (e.g. at the Embassies)?
☐ Yes

☐ No

If yes, please state who these organisations are and what their task is:

Does your government systematically follow/analyze S&T developments and S&T policy in China?
☐ Yes

☐ No

If yes, please briefly describe how:

What are the most important challenges with regard to S&T cooperation with China?

Please comment on most important experiences/insights/lessons learnt from your S&T cooperation with China

Do you monitor research cooperation with China (i.e. gather statistics on exchange of scientists, institutional cooperation agreements, output in terms of co-publications, co-patenting, etc.)?
☐ Yes

☐ No

If yes,

a) Please briefly name the main indicators and describe how you monitor them:

b) Please attach recent figures of the past 5 years.

Has there been any evaluation of S&T cooperation with China in your country within the past 3 years?

☐ Yes

☐ No

If yes, please describe the process/outcomes (Please attach the evaluation report, if available):

Please briefly describe up to three examples of S&T cooperation with China and comment on how they were successful/unsuccessful (this could include university cooperation, joint projects or labs, government cooperation etc.)?

Do you support the idea of exploring options for an enhanced coordination or joint approaches of MS/AS activities towards China?

☐ Yes

☐ No

If yes, what could be major issues where MS/AS benefit from a coordination of there activities?

a) Setting a joint framework for MS/AS S&T activities
(mobility, IPR, investments, …):

b) topics for multilateral S&T cooperation of different MS/AS with China:

If no, please state briefly your reasons below:

Thank you very much for your cooperation!

Annex (c): Terms of Reference for the 'Analysis of emerging economies/ upcoming competitors'

Background

1. According to the Lisbon Agenda, one of the central goals of Europe is, to become the worldwide leading knowledge based economy. Already for this reason, there is a strong need to have an in-depth look at S&T policies of other worldwide leading economies (USA, Japan) as well as of emerging economies to become Europe's upcoming competitors as there are countries like China, India, Russia and South Korea.
2. These countries are either already at the high end of S&T performance or are undergoing very dynamic developments including the S&T sector as one of the drivers of economic growth. For this reason, they offer a lot of opportunities due to their S&T intensity and their innovative capacities allowing the exploitation of S&T results on established lead markets and in a number of cases on rapidly growing markets.
3. As a consequence, these countries are on the one hand interesting partners for S&T cooperation but on the other hand they (to some extend quite aggressively) gain international knowledge and technologies, attract foreign scientists and direct investments as competitors of Europe.

Objectives of the analysis

- Develop an understanding of policy strategies and respective instruments of emerging economies including the role of the private sector.
- Identify 'good practice' and learn lessons from the competitors in terms of policy approaches for the internationalisation of S&T.
- Identify 'good practice' and learn lessons from the cooperation between MS/AS and emerging countries as well as between major international competitors of the EU and emerging countries.
- Draw conclusions on implications for MS/AS balancing cooperation and competition with emerging economies.

Approach

In a first stage, 'China' as a pilot case will be studied in a three step procedure:

1. **Analysing existing literature** (studies, surveys, policy documents) on 'China' with emphasis on national S&T policy, the link between the S&T system and economic interests, respective internationalisation policies (with emphasis on the relations to the EU) and on policy approaches of major international competitors of the EU (USA, Japan, Russia).
2. **Exchanging views in the CREST Working Group** on MS/AS S&T policies and experiences towards 'China' with a view to identifying good practices and lessons learnt of individual MS/AS.

3. Preparing a condensed **analytical report on 'China' including implications for MS/AS and scenarios for coordinated or joint actions** on the basis of the literature review and the exchange of practices and experiences in the CREST Working Group.

Key questions for the analysis

- What are the major S&T policy objectives of China and to what extent does international S&T cooperation contribute?
- What are the main drivers and inhibitors of Chinas dynamic development of the S&T system (incl. human potential as an asset)?
- What are the major instruments and priorities of Chinas S&T cooperation with international partners? Is there anything specific with regard to the EU (MS/AS) in terms of instruments and priority topics? Could lessons be learnt for MS/AS policies?
- What are Chinas strategies to gain/attract foreign knowledge and investments?
- What are the implications for the EU as response to Chinese strategies?
- What are major success stories and failures of S&T cooperation between MS/AS and China?
- What do major competitors of the EU do (emphasis on USA, Japan, Russia) in terms of objectives, priorities and instruments and outcome?
- What are major barriers and threats for S&T cooperation with China?
- Is there any 'good practice' to meet Europe's interest in a fair exploitation of its intellectual property in China or an exploitation of joint IP from collaborative activities?
- What are (expected) benefits from a closer coordination of MS/AS activities towards China? Are there lessons learnt (i.e. from the ERA-NET CO-REACH)?

Annex (d): Lessons learnt from the S&T cooperation of Member States/Associated States with present and future international competitors: Pilot case China

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According to the Lisbon Agenda, one of the central goals of Europe is, to become the worldwide leading knowledge based economy. In this context, there is a strong need to have an in-depth understanding of S&T policies of other countries, including some emerging economies which are becoming both important partners and competitors for Europe. As a pilot case, annex (d) provides an insight into China´s S&T strategies (section 1) including internationalisation as a major pillar (section 2). Section 3 describes the present state and major trends of the S&T relations with Europe followed by a brief summary of China´s cooperation with selected other countries in section 4. Section 5 describes major lessons learned for realizing the full potential of S&T cooperation with China. Conclusions for MS´/AS´ and Community actions are drawn in section 6.

Main conclusions:

I China's development is part of a fundamental change which is currently transforming the global distribution of knowledge resources. China's emergence as a magnet for, and increasingly also a source of, frontier-level science and high technology puts demands on other countries and regions to formulate strategies on how to relate to it and other emerging giants within research and education.

II China's opening to the world, the government's prioritisation of science and education and its desire to acquire knowledge and technology provide important opportunities, and vehicles for establishing cooperation on issues of global relevance such as environmental protection, corporate social responsibility, among others.

III So far, S&T cooperation with China shows the tendency to lead mainly to knowledge transfer from Europe to China without yielding significant economic or other benefits to Europe in return. In addition, the MS/AS are faced with a number of challenges, most dominantly the protection of intellectual property but also a growing Chinese techno-nationalism and protectionism.

IV S&T cooperation with China is not and should not only be about research excellence. Rather, Europe, both at national and at Community level needs to consider the wider context and impact of S&T relations with China, which include political relations and issues of global relevance (pollution, civil society, health, etc.)

Recommendations

I. Clearly define goals of S&T cooperation with China in general and of specific cooperation activities (programmes, projects) in particular; Devise clear strategies which set out goals and objectives of S&T cooperation with China

II. Consider targeted coordination in fields such as:

   a. exchange of experience/information (analysis on China, exchange of experiences, mutual learning exercises);
   b. high-level dialogue on political coordination
   c. Coordination on concrete issues of common interest: IPR, public procurement, etc.
   d. Projects or programmes in areas of global relevance: environment, climate, energy, health, ageing etc.
   e. Pooling resources for managing growing inflow of Chinese students to Europe (visa handling, verifying student qualifications, etc.)

III. Strengthen and, where relevant, pool analytical and policy-making competence on modern-day China (science and technology policy, innovation system, economy, etc.) both at national and Community level;

   a. Increase analytical resources both in China and at home
   b. Monitor developments in China systematically
   c. Encourage European students and researchers to study economics, politics, science, technology and innovation in and of China

IV. Link and coordinate S&T cooperation with China more closely to other foreign policy areas and foreign policy goals pursued by Europe, both at national and at Community level; such goals could be related to issues of global development

(environment, energy efficiency, civil society, etc.) but they could also include goals such as strengthening effective IPR protection for European companies and inventors, or ensuring fair access and treatment of European companies to Chinese markets.

V. Seek, where possible, to counteract tendencies towards technonationalism both in China and in other countries

VI. Carry out impact evaluations of S&T cooperation (both ex post and ex ante) with China at national and community levels. These evaluations should focus on scientific impact but also on whether the cooperation with China contributes to other goals, such as strengthening political ties, contributing to global development, and/or fostering economic development and innovation at home.

VII. Analyze human capital flows between China and Europe: particularly how Europe can attract the best Chinese students and how can Europe maximize the benefits from educating large numbers of Chinese students and researchers (networks, competence, etc.).

1. China's S&T system

Until 1965, the People's Republic was characterised by a strongly Soviet-inspired model for economic planning and technology policy with a bureaucratic and hierarchical R&D structure.[47] This system strongly hampered technological and scientific development even if China during this time developed both nuclear weapons and ballistic missiles (with support from the Soviet Union). The cultural revolution from 1966-1976 led to the loss of a generation of researchers. Many universities were closed and professors sent to the country side to work the fields and on farms. After Mao's death and Deng Xiaoping's accession to power, the People's Republic began its economic opening towards the rest of the world and the four modernizations were formulated (in agriculture, industry, research and development and defence).[48] While the roadmap has been adjusted since then, Deng Xiaoping's '*keji shi diyi shengchan li*' (*science is the first productive force*) has remained the guiding principle.

The reform of China's science and technology system, begun in 1985, belongs to the principal policy decisions that have enabled China's progress in economics, research and development in the past 20 years.[49] Whereas China's science and technology resources had previously been closely connected to, and driven by, its military needs, the government formally acknowledged that these resources were of vital importance for economic development. Consequently, China made a deliberate decision to link science and technology to the productive sector.[50]

47 For a good overview over the historical development of China's science and technology system and policies, see Ke Yan, Chinese Science and Technology: Reform and Development (translated by Chen Ru), China Intercontinental Press, 2004.

48 Zhicun Gao and Clem Tisdell, 'China's Reformed and Technology System: An Overview and Assessment', Prometheus, Vol. 22 Nr. 3, September 2004, pp. 311-331.

49 For a critical assessment of China's latest long-term plan for science and technology see Sylvia Schwaag Serger and Magnus Breidne, 'China's 15-year plan for science and technology: an assessment', Asia Policy, July 2007.

50 Kathleen Walsh, Foreign High-Tech R&D in China, Henry L. Stimson Center, Washington, D.C, 2003.

Dramatic increase in China's knowledge inputs and outputs …

Since the latter half of the 1990s, R&D expenditure has increased dramatically. Figure D.1 below shows that China's R&D expenditure as a share of GDP, has been growing much more rapidly than in any other country in Europe, the US and Japan. This growth is even more impressive when considering that, at the same time, China's GDP has grown by close to 9% per year on average.

At the same time as R&D expenditures have increased, China's R&D system has undergone far-reaching structural transformation. Business sector's share of total R&D expenditure increased from 30% in 1994 to 64% in 2004[51]. China's traditionally large research institute sector has been significantly reduced.[52] While the number of government research institutes has dropped, China's research institute sector continues to receive more funds for R&D than the university sector.

In addition to R&D expenditure, human resources in science and technology have increased rapidly. The number of new students has grown by around 24% per year on average since 1999.[53] Freeman estimates that, by 2010, China will produce more Ph.D.s in science and technology than the US.[54] IPR legislation has been strengthened at the same time as China is working towards developing domestic standards.[55] Finally, China has rapidly become one of the most attractive locations for foreign corporate R&D activities. China attracts more foreign direct investments than any other country in the world with the exception of the USA and the UK.[56] During the past five years, hundreds of new R&D centres have been established by foreign companies in China and in several recent surveys, executives from multinational companies rated China as the most attractive country for future R&D investments.[57]

51 National Bureau of Statistics (ed.), China Statistical Yearbook on Science and Technology 2005, edited by National Bureau of Statistics and Ministry of Science and Technology (MOST), 2005, China Statistics Press.

52 Richard P. Suttmeier, Cong Cao and Denis Simon, 'Knowledge Innovation' and the Chinese Academy of Sciences', Science, 7 April 2006, Vol. 312, pp. 59-59.

53 The growth in the number of new students can be expected to taper off as China's birth rate (measured as a ratio of the number of birth to the average population) declines. At the same time, the share of Chinese people with secondary and tertiary education is likely to continue to grow, thus partially offsetting the falling birth rate.

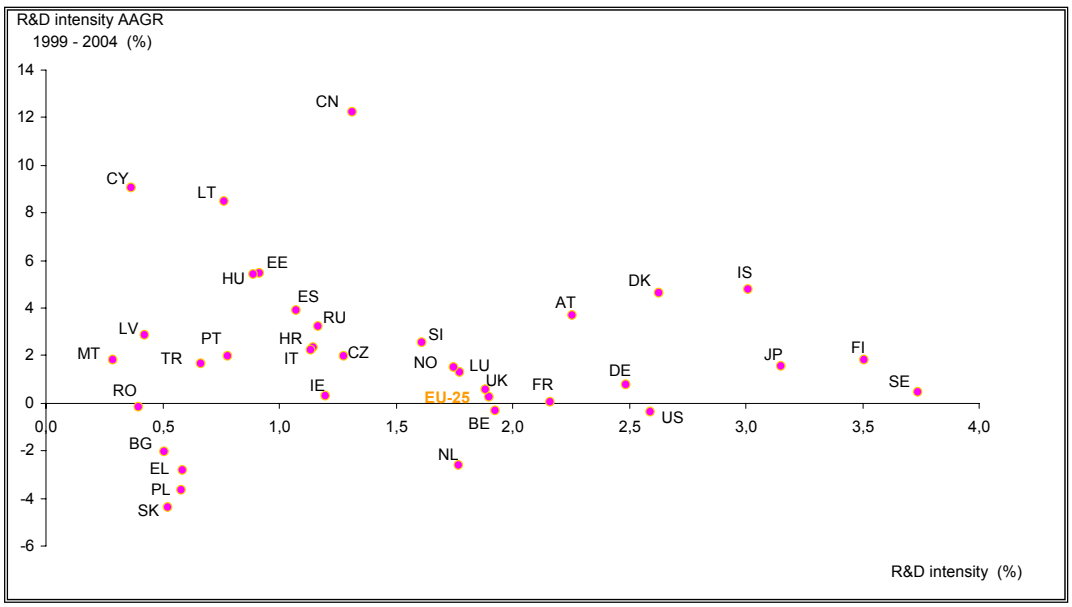
54 Richard B. Freeman, 'Does Globalisation of the Scientific / Engineering Workforce Threaten US Economic Leadership', NBER Working Paper 11457, June 2005, http://papers.nber.org/papers/w11457.pdf

55 China National Institute of Standardization (CNIS), 'General Report of Research on China's Technical Standardization Development Strategy', Draft Version, China National Institute of Standardization, and Richard P. Suttmeier and Yao Xiangkui, China's post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism, NBR Special report 2004, National Bureau of Asian Research.

56 UNCTAD, World Investment Report 2005. For a more in-depth analysis, see Sylvia Schwaag Serger, 'China: from shopfloor to knowledge factory?' in Magnus Karlsson (ed), The Internationalisation of Corporate R&D. Leveraging the Changing Geography of Innovation. Swedish Institute for Growth Policy Studies (ITPS), 2006.

57 ibid.

Figure D.1: R&D intensity in 2004 and annual average growth rate (AAGR) of the R&D intensity (R&D expenditure as a % of GDP) (1999-2004)



Source: Eurostat (2006), 'R&D expenditure in Europe', Statistics in Focus Nr. 6/2006.

Knowledge inputs have also grown, albeit not at the same pace as inputs. China has jumped from 13th place in the mid 1990s to 4th place in terms of share of world total publications. Patents grew by around 40% in 2005 even if they still account for a small share of total patents registered with the World Intellectual Property Organisation (WIPO). China has become a large exporter of high technology products, which accounted for 25% of its total exports in 2005.

…but significant challenges remain

China's research and education system still faces considerable challenges. While business sector R&D has increased rapidly, R&D expenditure as a share of value-added remains low.[58] Furthermore, a large share of China's business expenditure on R&D is carried out in large state-owned enterprises (SOEs) whose ability both to innovate and to absorb knowledge is often low.[59] Finally, basic research accounts for a small share of total R&D, compared with many other countries.[60]

Chinese universities have been struggling to cope with a dramatic expansion of students which has occurred at the same time as public funding for education has stagnated. This, combined with the introduction of tuition fees and the partial privatization of education, has led to large inequality in terms of access to and quality of education.[61] Furthermore, academic corruption is a serious problem which is increasingly receiving at-

58 R&D expenditure in the Chinese manufacturing sector corresponded to only 1.9% of value added in 2004, compared with between 7 and 11% in France, Germany, Japan, Korea, the UK and the US. China High-Tech Industry Statistics 2006.

59 Chi Hung Kwan, 'Who Owns China's State-Owned Enterprises? Toward Establishment of Effective Corporate Governance', China in Transition, RIETI, 28 July 2006, (http://www.rieti.go.jp/en/china/06072801.html), Y. Li, Y. Liu and F. Ren, 'Product innovation and process innovation in SOEs: Evidence from the Chinese transition', Journal of Technology Transfer, Vol. 32, 2007, pp. 63-85, and China Daily, 'SOEs have low innovation capacity: official', 18 Nov. 2005.

60 Only around 6% of China's R&D expenditure is allocated to basic research compared with around 14% in Korea and Russia and around 25% in the US and Europe.

61 See, for example, OECD, Governance in China, 2005.

tention.[62] Also, several indications currently point to a fundamental mismatch between the education offered by many of Chinese universities and the skills demanded in the labour market. The education system is producing university graduates at a rapidly accelerating pace; yet, a significant number of these graduates cannot find employment even though there is severe shortage of highly skilled labour.[63] Finally, China's strategy of attracting foreign technology and knowledge is regarded by domestic and foreign observers as having been only partially successful. One of the most important goals of China's technology and research policy so far has been to construct a domestic capacity to produce high technology goods. By combining foreign direct investments with the development of theoretical technical expertise, the government has tried to trigger a chain reaction leading from import to assimilation to the ability to generate own technology. Within many sectors, this goal has not yet been reached. Thus, a large share of China's high tech export still consists of the import of high-tech components which are assembled in China and then exported abroad.

Science, technology and innovation to solve economic and social challenges

China's determination, since the beginning of the 1980s, to strengthen the country's knowledge base and innovation capacity, is driven by a combination of real and serious challenges, and a strong – some would say excessive – faith in the ability of technology to help China overcome these challenges. China's research policy is strongly needs-driven: science and technology are seen as tools for combating environmental problems, epidemics and poverty, for meeting China's growing demand for raw materials, for securing the country's future competitiveness and growth, but also for realizing the government's political ambitions.[64] The overarching goal of China's long-term plan is to maintain a high rate of economic growth and development but also to provide technological solutions to social and environmental challenges. Even if energy and the environment are at the top of the list of prioritised technology areas, attempts by the government to slow down growth in order to save the environment have so far been relatively unsuccessful. High unemployment in certain regions and sectors puts the government under pressure to maintain growth and avoid political unrest which might result from further increases in unemployment. Furthermore, high economic growth, which has long been the key indicator of success, is still one of the top goals of provincial and local governments who therefore often don't support, or even undermine, targets set at national level to restrain growth.

62 See for example, Liu Ming, Critique of the Academic Evaluation System, Changjiang Literature and Arts Publishing House, 2006, Business Week, 'Science Friction', 29 May 2006, The Economist, 'Faking it; Chinese science', 20 May 2006 and Nature, 'Frequent cases force China to face up to scientific fraud', August 2006.

63 See, for example, Diana Farrell and A. J. Grant, 'China's Looming Talent Shortage,' The McKinsey Quarterly, 2005:4, pp. 70-79, and China Daily '1.24m grads can't find major-related jobs', 18-19 November 2006.

64 C. Jr.. Wolf, K. C. Yeh, B. Zycher, N. Eberstadt and S-H. Lee, Fault Lines in China's Economic Terrain, MR-1686, 2002, RAND Corporation.

The future: China's Long-Term Plan for S&T Development[65]

Against the above described background, on 9 February 2006, the State Council presented its strategy, or programme, for strengthening China's scientific and technological progress in the coming 15 years.[66] The strategy is an indicator of how China's political leadership aims to strengthen China's future economic and technical development – something which will undoubtedly also have a profound impact on the rest of the world. It reflects China's clear ambitions to make the country one of the world's most important knowledge bases and innovation countries. The most important aspects of the plan can be summarised in three points. Firstly, R&D expenditure as a share of GDP will be increased by 2020 to 2,5% of GDP (from the current level of 1,4%). In the same year, it plans to achieve another key goal, that is, the quadrupling of GDP compared with 2000. Already today, China has the third-largest expenditure on R&D in terms of purchasing power parity, trailing only the US and Japan, according to the OECD. [67]

Secondly, China's domestic innovative capacity is to be strengthened and its dependence on foreign technology to be reduced. The declared intention to strengthen 'independent' or 'indigenous' innovation is perhaps the most striking feature of the new plan, and certainly the one most widely discussed by foreign firms and experts. This has raised concerns over the rise of so-called 'techno-nationalism' or 'neo-techno-nationalism' and of what this new emphasis means for China's future economic openness but also for the protection of foreign intellectual property in China.[68] One of the declared aims is for China to establish its own technology platforms, to identify and lay a claim to new technology areas where China can take the lead, and to play a greater role in setting standards for consumer products.[69] The desire to reduce dependence on foreign technology is partially driven by the current dominance of foreign technology in strategic areas such as processors and software and by the desire to avoid paying high licensing fees. An additional motivation is that homemade technology within a number of areas can provide important bargaining leverage when acquiring technology in other areas. Last but not least, the aim to reduce reliance on foreign technology is also a question of national prestige.

Thirdly, companies are identified as being at the heart of and the most important driving force of the innovation process. One of the most noteworthy methods suggested in the plan is the introduction of tax incentives for small and medium sized enterprises (SMEs). These and other financial incentives are intended to encourage companies to invest in R&D and even to establish R&D activities abroad. The latter is particularly

65 For a more in-depth analysis of China's 15-year plan see, for example, Cong Cao, Richard P. Suttmeier and Denis Fred Simon, 'China's 15-year science and technology plan', Physics Today, December 2006, pp. 38-43 and Sylvia Schwaag Serger and Magnus Breidne, 'China's 15-year plan for science and technology: a critical assessment', Asia Policy, July 2007.

66 State Council of the People's Republic of China (SCPRC), Outline of the Long-Term National Plan for the Development of Science and Technology (2006-2020); State Council Decision Notice of the Implementation of the Long-Term Plan for the Development of Science and Technology and the Increase of Independent Innovation, China Legal Publishing House, 2006, Beijing.

67 OECD, Science, Technology and Industry Scoreboard 2005. It should be noted, however, that attempts to measure China's R&D in purchasing power parity (PPP) terms are subject to discussion; it is extremely difficult, for example, to account for large regional cost differences within China.

68 for a discussion of techno-nationalism and neo-techno-nationalism, see, for example, Suttmeier and Yao, China's Post-WTO Technology Policy.

69 For a discussion of China's efforts to develop standards see Richard P. Suttmeier and Xiangkui Yao, China's Post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism, NBR (National Bureau of Asian Research) Special Report 2004, or Scott Kennedy, 'The Political Economy of Standards Coalitions: Explaining China's Involvement in High-Tech Standards Wars', Asia Policy, July 2006, pp. 41-62.

interesting and quite unique, and is likely to lead to an increased presence of Chinese companies in science or technology parks in the US and Europe.

2. China's international S&T strategies: Core objectives and instruments

Internationalisation is a key component of China's science and technology system and policies. In particular, international cooperation in science and technology is seen as one of the most important tools for acquiring know-how and technology and thus for China to 'boost the country's S&T capabilities in leapfrog fashion by capitalizing on technology developed elsewhere'.[70] Several policies reflect the importance attached and the central role assigned to internationalisation:

Objective: Attracting foreign direct investments and particularly knowledge-intensive investments

Attracting foreign direct investments and particularly technology- and knowledge-intensive investments has been a pillar of China's economic reforms (see above). China offers a number of incentives to induce foreign companies to locate R&D activities in China.[71] Since China began to open to foreign companies, it has pursued a determined policy that requires companies interested in producing or selling goods and services in China to transfer technology.[72] While officially, this requirement was removed in 2001, in practice, many companies are still 'encouraged' or pressured to locate R&D in China.[73] Furthermore, companies are establishing R&D operations in China because significant tax rebates and other financial incentives are on offer.[74] Science parks and high-tech development zones advertise tax rebates and other benefits on their websites for companies willing to establish R&D activities on their premises.[75] Examples of policies targeting foreign technology-intensive activities are exemptions from customs duties and VAT on the import of equipment and technologies for self-use. Gains from technology transfer activities can be exempt from business and enterprise income taxes. Some R&D and wage expenses can be used to offset enterprise income taxes.

China's strategy has been successful in the sense that a large number of foreign firms have established R&D activities in China. However, so far, the positive spillovers from foreign corporate R&D in China have been limited.[76]

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70 U.S. China Science and Technology Cooperation (S&T Agreement), report to Congress, 15 April 2007, p. 71.

71 See, for example, Schwaag Serger, 'From Shopfloor…' for an overview over the incentives provided to foreign companies.

72 Oliver Gassmann & Zheng Han 'Motivations and Barriers of Foreign R&D Activities in China,' R&D Management, Vol. 34, No. 4, 2004, pp. 423-237.

73 Walsh, Foreign High-Tech R&D. G. Long, 'China's Policies on FDI: Review and Evaluation,' in T. H. Moran, E. M. Graham & M. Blomström (eds.), Does Foreign Direct Investment Promote Development? Institute for International Economics, Washington, D.C. 2005, pp. 315–336.

74 Preferential FDI policies include low tax rates or tax exemptions on VAT, corporate taxes and income taxes, exemptions from import tariffs on production inputs imported by Foreign-Invested Enterprises (FIEs), favourable land use rights, administrative support, subsidised office rents, etc (see, for example, Hong Kong Trade Development Council 2004, and Hou 2004). Foreign companies establishing themselves in China are exempt from corporate income tax for the first two years that they make a profit. After that, they are subject to 15% corporate income tax on average, which is much less than the normal rate for Chinese companies of 33% (Prasad and Wei 2005).

75 See, for example, Jiangsu Province Taixing Economic Development Zone, www.chempark.com.cn/enwhh/htm/1_guide09.htm, or Xi'an High-Tech Development Zone, www.cbw.com/business/invest/xian/policies.htm

76 For an assessment, see Sylvia Schwaag Serger, 'Foreign corporate R&D in China: trends and policy issues', in New Asian Dynamics in Science, Technology and Innovation, ed. Govindan Parayil and Antony D'Costa, forthcoming 2007.

Objective: Attracting human capital

Encouraging Chinese to go abroad to study and to source knowledge has been an official policy of the Chinese government since the economic opening began under Deng Xiaoping.[77] Since 1978, more than one million mainland Chinese are estimated to have gone abroad to study. However, since only around one fourth are estimated to have returned. The government is increasingly concerned with this 'brain drain' and has put in place a number of policies for attracting both overseas Chinese to return and for highly-skilled foreigners to come to China. These policies include offering returnees low-interest loans and high salaries, but also exempting highly skilled returnees from the *hukou* (house registration) system, which determines where a person lives and works.[78] The Ministry of Personnel has even suggested the establishment of 'a talent security alarm system' to monitor emigration.[79] There are several scholarships or grants for overseas Chinese:

The National Natural Science Fund (NSFC) has a grant programme for 'Distinguished Young Scholars (with Foreign Citizenship)', which targets scholars of Chinese origin. Grantees receive 2 million RMB (approx. € 200.000) for four years.[80] Furthermore, there is a 'Joint Research Fund for Overseas Chinese Young Scholars'. The awardees of the latter Fund receive 400 000 RMB (or approx. € 40.000) for three years. In addition the NSFC has a 'Distinguished Young Scholars Programme'. According to Cao (2007), 99% of the scholars who had received this award between 1999 and 2004 had some foreign experience.[81] In 2007, the award amounted to 2 million RMB (approx. € 200.000) for four years per scholar.

The Ministry of Education offers 'Cheung Kong' scholarships. Approximately 90% of the awardees between 1999 and 2004 have foreign experience.

The Chinese Academy of Science (CAS) has a 'One Hundred Talent Programme'. Close to 87% of the awardees were recruited from abroad. Recipients are awarded 2 mill. RMB, approx. € 200.000. Furthermore, fellows receive housing, a laboratory, equipment and a research team, as well as immediately becoming full professors.[82]

A number of local governments have established science parks which specifically target overseas Chinese. Examples include the 'Shenyang Overseas Chinese Scholars Innovation Park'.

While recent figures indicate that government policies have been successful in increasing the number of returnees, some observers question the extent to which China has been able to provide the necessary incentives or framework conditions that would encourage the 'best and brightest' overseas Chinese to return to China.[83]

77 David Zweig, 'Is China a Magnet for Global Talent?', Working Paper, Hong Kong University of Science and Technology Center on China's Trans-national Relations, 2006.
78 Kent Ewing, 'Keeping China's Best and Brightest at Home', Asia Times, 15 June 2007. See also Zweig, 'Is China a Magnet …?'.
79 Ewing, 'Keeping China's Best and Brightest…'.
80 National Natural Science Foundation of China (NSFC), Annual Report 2006.
81 Cong Cao, 'China's Brain Drain and Brain Gain: Why First-Rate Overseas Chinese Academics Still Hesitate to Return or be Deeply Involved in China's Education and Scientific Enterprises?' Draft Paper (quoted with the author's permission), Hong Kong University of Science and Technology Center on China's Trans-national Relations, 2006.
82 Zweig, 'Is China a Magnet…?'
83 See Zweig, 'Is China a Magnet…?' and Cao 'Chin's Brain Drain…'.

In addition, the Ministry of Science and Technology (MOST) has established overseas high-tech parks, in Singapore, Maryland, USA, Cambridge and Manchester, UK and Moscow, Russia, to 'make most of overseas talent'.[84]

Objective: Encouraging domestic firms to seek knowledge abroad

In recent years, the government has encouraged Chinese firms to 'go global', that is, to establish themselves and gain a greater presence abroad. In its latest long-term plan for science and technology, in addition to its strategies for attracting knowledge and human capital from abroad, China explicitly calls upon its firms to go abroad in search of technology and know-how. More specifically, Chinese firms are encouraged to establish R&D facilities abroad. In the plan, the government proposes to 'grant foreign exchange and financing support for businesses to establish R&D institutes in foreign countries and provide them with foreign investment facilities and top-notch service'.[85] The provision of incentives for domestic firms for setting up R&D facilities abroad is rather unique when compared with other countries.

3. China S&T relations with Europe: Major trends

The dramatic increase in China's knowledge resources and its ambitions to become a leading innovation country has far-reaching implications for the rest of the world. In this section some of the consequences for Europe and respective policy implications are examined.

3.1 International mobility of Chinese and European students and researchers

In 2005, 118.500 Chinese studied abroad, 106.500 of these did so at their own, or their families', expense.[86] In recent years, several European countries have experienced a significant increase in the number of Chinese students studying in Europe, with the UK attracting by far the largest number of Chinese students, close to 50.000 in 2004, followed by Germany, at around 25.000 and France, at around 15.000.[87] Of all Chinese students abroad in 2004, 25-30% studied in Europe.[88]

By contrast, the number of students from EU countries studying in China is much smaller. Using Germany as an example: Whereas 27.000 Chinese studied in Germany in 2005 only around 1.300 Germans studied in China in 2004. Similarly, far more Chinese do research in Europe than vice versa. Moreover, whereas Chinese students in Europe study natural and engineering sciences, management and economics, the majority of EU students who go to China focus on language studies.

This trend raises two concerns. Firstly, Europe has a shortage of people who understand economics and politics, business, science and technology in China. Secondly, there are too few European students and researchers tapping into important S&T networks and centres of excellence in China.

84 People's Daily Online, 'New ways to attract overseas intellectuals to China', 22 March 2007.
85 State Council of the People's Republic of China, National Outline for Medium and Long Term Science and Technology Development Planning (2006–2020), 9 February 2006.
86 Chinaview, 'Number of Chinese students abroad exceeds one million', 27 February 2007.
87 Swedish National Board for Higher Education (*Högskoleverket*), *Studentmobilitet – högskolestuderandes internationella rörlighet*, 2007 and information from French delegate in CREST Working Group.
88 Ibid.

3.2 S&T cooperation between China and Europe

Bilateral S&T Cooperation with China of Member States/Associated States

In a recent survey[89], EU Member States (MS) and Associated States (AS) were asked about their S&T cooperation with China. All 20 countries which responded to the survey consider China as a (if not the) priority partner country and currently promote S&T cooperation China. Nearly all plan to further increase S&T cooperation with China. The most frequently used instruments are mobility schemes, joint research projects or programmes, information exchange, meetings and seminars, and joint R&D labs.

The ***policy objectives*** listed for S&T cooperation with China can be grouped into five categories:

- to extend national R&D through cooperation based on scientific excellence;
- to strengthen ties and cooperation with China in general (political instrument;
- to enhance economic and business development and innovation at home.
- to promote Chinese development;
- to address global issues (environment, pollution, epidemics);

Eight countries listed the extension of national R&D activities as an objective for S&T cooperation with China, making it the most frequently listed objective (see Figure D.2).

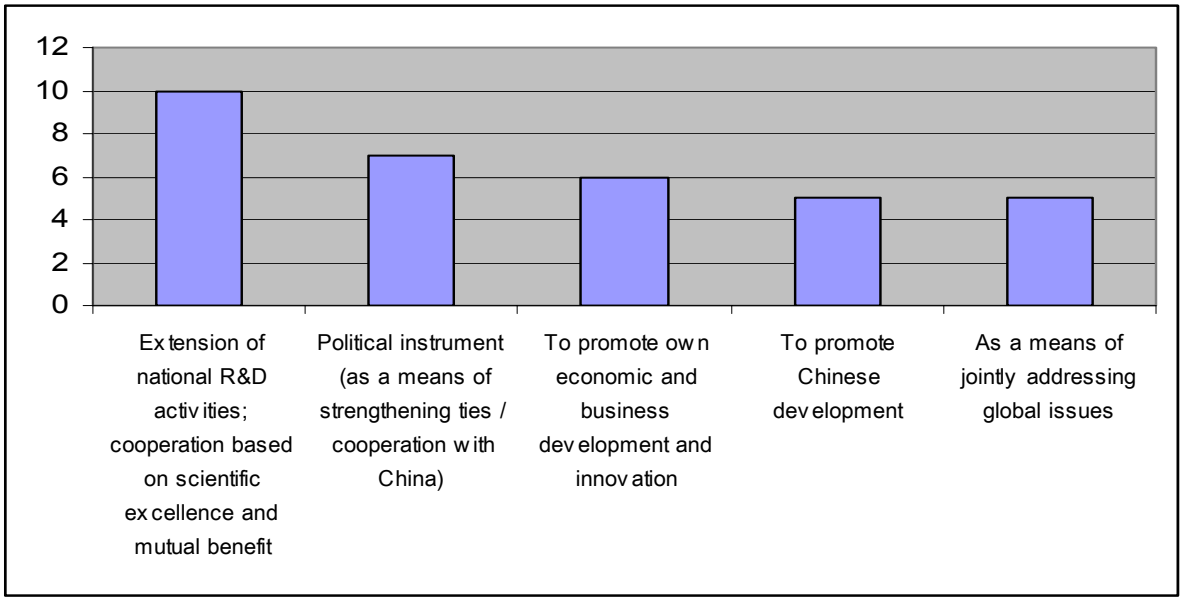
The most important ***thematic priorities*** for S&T cooperation with China were environment and energy, ICT, biotechnology and health, and nanotechnology and material sciences.

The importance of the S&T cooperation with China is underpinned through the number of science and technology counsellors of MS in China (Table D.1).

As a major ***trend***, S&T cooperation between China and European countries is increasing rapidly. For example, there are currently more than 120 cooperation agreements between Swedish and Chinese universities, half of which have been signed since 2003.

89 A large part of this section is based on a survey on S&T cooperation with China among member states and associated states which was carried out in June 2007. 20 MS/AS filled in the questionnaire. It should be pointed out that the results from the survey do not provide comprehensive coverage of MS/AS S&T activities with China. In many cases S&T cooperation is a 'bottom-up' or decentralised process, which means that ministries or governments often do not have a complete picture.

Figure D.2: Objectives of S&T cooperation with China



Source: Policy questionnaire on S&T cooperation with China – CREST WG on policies towards the internationalisation of R&D (Annex b)

Table D.1: Countries which have designated science/technology counsellors/ attachés in China

	S/T counsellors, technical attachés	Total 'non-local' staff	Locations
Denmark	1	6	Shanghai
Finland	2	4	Beijing, Shanghai
France	2	4	Beijing
Germany	1	2	Beijing
Hungary	1	1	Beijing
Italy	1	1	Beijing
Netherlands	2	5	Beijing, Shanghai, Guangzhou
Norway	1	1	Beijing
Romania	1	1	Beijing
Spain	1	1	Shanghai
Sweden	2	2	Beijing
UK	1	5	Beijing, Chongqing, Guangzhou, Shanghai
Total	**16**	**33**	

Source: Policy questionnaire on S&T cooperation with China – CREST WG on policies towards the internationalisation of R&D (Annex b)

Some new trends in S&T cooperation with China at MS'/AS' level include:

- The setting up of incubators or innovation centres, aimed at supporting home country firms seeking to establish themselves in China (Finland's Finnish-Chinese Innovation Centre in Shanghai – FinChi; Denmark's Innovation Centre in Shanghai)

- A stronger focus on innovation aspects in S&T relations with China (Denmark, Ireland, Finland, France, Norway, Sweden, UK)
- The undertaking of impact assessments or evaluations of research cooperation with China

S&T cooperation with China: Community level

Science and technology cooperation between the European Union and China started in the late 1980s and was formalized with the signing of a science and technology agreement in 1998. This agreement was renewed in 2004. The importance assigned to science and technology cooperation between China and the EU was underlined by the launch of the EU-China Science and Technology Year, which ran from October 2006 to September 2007.

Chinese research teams have been or are participating in close to 200 joint research projects within the 6th Framework Programme for Research and Development (FP6), making China the second largest non-EU country participant after Russia but before the US. The majority of projects with Chinese participation can be found in the field of ICT. It is estimated that some € 33 million have been paid to Chinese researchers by the EU in the context of FP6. As regards FP7, the European Commission is in the process of initiating targeted calls or even Specific International Cooperation Activities (SICAs) dedicated to the cooperation with China in the fields of health, climate and energy.

By contrast addressing the issue of reciprocity, it is very difficult for European researchers to get funding from Chinese research programmes, such as the 863 or 973 programmes - the only examples which were found are those of ethnic Chinese, with foreign passports.

Aside from participation in the EU Framework Programmes, China participates in Europe's Galileo satellite-navigation system and in the International Thermonuclear Experiment Reactor (ITER). The Chinese government makes a significant financial contribution to the Galileo project. Several recent developments illustrate that the European Commission is paying increasing attention S&T relations with China. Firstly, China is now included as one of the 43 countries monitored in ERAWATCH (http://cordis.europa.eu/erawatch), an initiative by the European Commission implemented by the Joint Research Centre/Institute for Prospective Technological Studies (IPTS).

It should be noted, that the European Commission has recently commissioned an impact evaluation of research cooperation with China – results will be available in due term.

An issue of growing importance became the coordination of S&T activities at MS'/AS' level, as they are supported by the ERA-NET scheme starting with FP6. Here, the European Commission also currently funds a network of European S&T policy and funding organisations involved in promoting research cooperation with China, entitled CO-REACH (see box below).

Practice example: CO-REACH

CO-REACH is a network of European S&T policy and funding organisations launched in May 2005 and involved in promoting research cooperation with China in the natural sciences, medical and life sciences, engineering sciences, social sciences and humanities. The aim of CO-REACH is to create coherence and synergy in Europe's S&T relations with China by promoting the coordination of China-related policies and research funding programmes of individual European countries, and by integrating these efforts with other multilateral European initiatives, including those of the European Commission. CO-REACH is supported by the European Commission as an ERA-NET Coordination Action. The CO-REACH consortium currently includes 13 partners (5 scientific academies, 5 research councils and 3 ministries) from 8 European countries, as well as 7 observers.

Objectives

The primary goal of CO-REACH is to establish new European programmes of research cooperation with China. These new programmes will build on the strengths of CO-REACH partners' existing bilateral programmes with China and will collectively address priority issues that fall beyond the capacities of individual European countries. CO-REACH seeks to fulfil four main objectives, namely:

- Contribute to building the ERA by counteracting the fragmentation of institutional, national and regional efforts at promoting research cooperation with China.
- Strengthen the international dimension of the ERA and provide a gateway to European S&T for Chinese organisations and researchers.
- Strengthen European S&T relations with China by building the critical mass required for the support of new European programmes of research cooperation with China, and making optimal use of resources to benefit European and Chinese S&T communities, economies and societies.
- Foster strategic policy-making on research cooperation with China; identify research needs and priorities, as well as future challenges and opportunities, in Europe and China.

Interims results

- Mapping of bilateral programmes by CO-REACH partners and observers with China
- Benchmarking & Best Practices Report
- Analytical report 'Bilateral collaboration with China: trends, systems and challenges'
- Establishment of CO-REACH national steering committees in some member countries

One of the first deliverables is the ONLINE CO-REACH DIRECTORY accessible via www.co-reach.org. The directory is an information source for scientists and policymakers from both China and Europe, providing an overview of funding opportunities for cooperation. Currently, the directory includes information on bilateral funding schemes of CO-REACH partners and observers. The aim is to expand the directory with schemes

of other national organisations in Europe and China. The ultimate goal is to become a 'Gateway to Europe' for European and Chinese scientists and policy makers.

3.3 Foreign Direct Investments

Foreign companies' establishment of R&D centres in China is a relatively recent but rapidly growing phenomenon.[90] While in the 1980s and 1990s there were relatively few R&D activities by foreign companies in China, since 2000, foreign corporate R&D in China has increased dramatically. Furthermore, while adaptive R&D continues to dominate foreign firms' R&D activities in China, a large number of multinational companies, many of whom are technology leaders in their fields, are increasingly locating innovative R&D in China.[91] Today, foreign firms rank China as one of the most attractive locations for future R&D investments.

Chinese official statistics put the number of foreign R&D centres as high as 1000. For several reasons, the number of operative centres actually carrying out R&D is likely to be considerably smaller.[92] According to von Zedtwitz, there were 199 operative foreign R&D facilities in China in early 2004. The number has increased rapidly since then, possibly amounting to around 350-450 by 2006.[93]

In addition to R&D activities only aimed at adapting products to the Chinese market, a number of companies are choosing China as one of a select group of countries for setting up global R&D centres.[94] While adaptive R&D can be argued to be location-specific, determined by the need for proximity to a market, innovative or global R&D refers to activities which, in theory, could be carried out elsewhere in the world. Nokia's research centre in Beijing, for example, is one of the company's eight research labs in the world.[95] Two out of a total of Siemens' 13 global corporate technology centres are in China (Beijing and Shanghai).[96] Unilever lists its research centre in Shanghai as one of six global R&D sites.[97] Of Fujitsu's seven R&D laboratories, two are in China

90 For a more in-depth discussion of foreign corporate R&D in China, see, for example, Sylvia Schwaag Serger, 'China: From Shopfloor to Knowledge Factory?' in Magnus Karlsson, Internationalisation of Corporate R&D; Leveraging the Changing Geography of Innovation, Swedish Institute for Growth Policy Studies (ITPS) 2006, and Max von Zedtwitz, 'Managing Foreign R&D Laboratories in China,' R&D Management Vol. 34, Nr. 4, 2004, pp. 439-452.

91 The term 'innovative' is used to differentiate between R&D activities devoted merely to adapting products to the Chinese market (adaptive R&D), and operations with a scope and nature that exceeds the domestic Chinese market. Centers with innovative R&D functions are also sometimes referred to as 'global R&D centers'.

92 Chinese authorities sometimes require companies to set up local R&D in return for being allowed to manufacture or sell in China. As a result, some R&D activities exist more on paper than in reality. Preferential treatment and government incentives for foreign R&D facilities may induce some foreign companies to register their activities as R&D even if they would not otherwise be classified as such. Companies may do so to establish goodwill with Chinese authorities since they strongly encourage foreign technology transfer. Gassmann & Han 'Motivations and Barriers…'.

93 This number is based on von Zedtwitz's figure from 2004 as a point of departure and then conducting a search of Chinese and foreign media articles, press releases and company reports to get an estimate of how many foreign companies have established R&D centers since 2004. There is a particular focus on companies with existing production facilities, or other relevant presence, in China, since it is unlikely for firms without manufacturing or other operations in China to set up R&D there. See Sylvia Schwaag Serger, 'Foreign Corporate R&D in China: Trends and Policy Issues', in Govindan Parayil and Anthony D'Costa, New Asian Dynamics in Science and Technology, forthcoming 2007.

94 Reddy (2005) distinguishes between five types of foreign R&D units, depending on the nature of the work they carry out; among others he identifies 'Global Technology Units' or 'Corporate Technology Units'.

95 According to its website, Nokia carries out research on visual interaction systems and adaptive terminals, among other things, at its Beijing research center (Nokia website 29 November 2006).

96 Company presentation, June 2007.

97 Unilever website (25 March 2007) http://www.unilever.com/ourvalues/sciandtech/How_where/On_the_map.asp.

(Beijing and Shanghai), three in the US, one in the UK, and one at the headquarters in Kawasaki, Japan.[98] A recent study finds around 40 large multinational companies that currently have up to 70 facilities with global R&D mandates in China.[99]

A number of ***European companies***, such as Ericsson, Nokia and ABB, have been among the pioneers, both when it comes to ***establishing R&D activities in China*** and when it comes to locating innovative R&D in China. Of the roughly 40 foreign firms with global R&D centres in China, approximately half are European.

When it comes to establishing global or strategic R&D in China, so far, telecommunications and IT or personal computer companies are at the forefront, whereas life-science companies have been less likely to locate such functions in there.[100] Recently, a number of chemical and pharmaceutical companies have announced plans to set up global R&D in China.[101] Thus, both Novartis and Astra Zeneca announced plans to invest US $ 100 million in R&D facilities in China. Furthermore, lately, a number of foreign-owned or foreign-invested global product design centres have sprung up in the Shanghai area. Philips, Sony, GM, Omron and Motorola are examples of companies that have established design centres in China. Companies with design operations are attracted to China because it offers good and inexpensive designers. Some are also starting to view the Chinese market as strategically important, not only because of its size, but because it is a dynamic and rapidly changing country that is assuming an increasingly significant role as global trendsetter. Thus, for example, Coca Cola recently developed a new soft drink at its facility in Shanghai, which is targeted at consumers in developing countries.[102]

Based on interviews as well as existing studies and surveys, three principal drivers for why foreign firms locate R&D in China can be identified.[103] The first driver is proximity to market and production. Many foreign centres are set up to adapt products and services to the strategically important Chinese market and/or to be near production facilities which are already in China. The second reason for companies to locate R&D to China is political or institutional conditions. Examples of this driving force include 'local content' rules, or national standards.[104] There are also national regulations that may require foreign companies interested in setting up production facilities to also set up R&D facilities, as well as fiscal incentives. The third factor attracting R&D to China is the supply of knowledge resources. While all three factors play a role in explaining foreign companies' R&D activities in China, the relative weight of each factor has changed over time.[105]

As with mobility, ***Chinese foreign direct investment (FDI) in Europe*** is very modest when compared with European FDI in China. While China's outward FDI has increased rapidly in recent years, so far, a large portion of Chinese firms' FDI activities abroad has been referred to as 'natural resource-seeking investments', and has thus been con-

98 Fujitsu website 29 November 2006.
99 Schwaag Serger, 'Foreign Corporate R&D in China…'.
100 A number of pharmaceutical companies have established clinical trial capabilities in China. The Danish company Novo Nordisk was one of the first to establish a global R&D centre in China, when it opened its lab in Beijing in 2002.
101 Jean-Francois Tremblay, 'R&D Takes Off in Shanghai', Chemical & Engineering News, Vol. 84, Nr. 34, 21 Aug. 2006, pp. 15-22.
102 The Economist, 'Orange Gold', 1 March 2007.
103 An overview of trends and drivers of international corporate R&D in general can be found in Karlsson ed. (2006) chapter 2.
104 See, for example, von Zedtwitz, 'Managing Foreign R&D in China'.
105 This analysis is derived by combining results from published studies with findings from interviews carried out with R&D managers and other experts between May 2005 and May 2007.

centrated in countries with abundant natural resources, such as Africa, Latin America, and the former Soviet Union.[106] Out of 59 outbound investment projects registered with the Ministry of Foreign Commerce (MOFCOM) between August 2006 and August 2007, only six were in Europe, one in Poland and five in Romania, while 20 were in Africa and 23 in neighbouring Nepal.[107] In total China's outbound investment flows, excluding the financial sector, reached 16 billion US dollars in 2006, compared with FDI inflows of around 70 billion US dollars.

A few Chinese firms have established R&D activities abroad and some of these can be found in Europe. Examples include Huawei and ZTE which have R&D centres in Stockholm, and Haier which has an R&D centre in Germany (see Table D.2). So far, the primary purpose of Chinese firms' R&D activities in Europe is to source knowledge abroad.

Table D.2: R&D centers by Chinese firms in the EU

Chinese firms	Location	Industry
Huawei	R&D centres in Sweden (Stockholm), U.S. (Dallas, Silicon Valley), India (Bangalore) and Russia (Moscow).	Telecom
ZTE	R&D centres in Sweden, (Stockholm), India (Bangalore).	Telecom
Glanz Group	R&D centre in U.S. (Silicon Valley)	Electronics
Konka	R&D centre in Silicon Valley	Electronics
Haier	R&D centre in Germany, US (SC) and India, design centre in Boston,	IT and electronics
Kelon	Design centre in Japan	Electronics
Foton Motor	R&D centre in Japan, Germany and Taiwan	Automotive

Source: Lundin et al (2007)

4. China's S&T cooperation with other countries

4.1 United States

The US-China Agreement on Cooperation in Science and Technology, signed by President Carter and Premier Deng Xiaoping in 1979, is one of the longest-standing agreements between the two countries. The guiding principle of the agreement has been 'to provide broad opportunities for cooperation in scientific and technological fields of mutual interest, thereby promoting the progress of science and technology for the benefit of both countries and mankind'.[108] When it was renewed most recently in 2006, the following areas, among others, were identified for continued and future cooperation:

- Fisheries;
- Emerging and infectious diseases (such as avian influenza, and HIV/AIDS);
- Earth and atmospheric sciences;

106 'Enter the Dragon: China's Investments', by Bill Powell, Time, 26 July 2007.
107 Invest in China website.
108 U.S. China Science and Technology Cooperation, Report to Congress, submitted 11 April 2005, p. 7

- Basic research in physics, chemistry, and agriculture;
- Energy-related areas;
- Geology;
- Health;
- Civil industrial technology;
- Disaster research.

Cooperation tools are exchanges of scientists, scholars, experts and students, and exchanges of scientific and technological information and materials. Other tools are joint planning and implementation of programmes, course, conferences, seminars, and projects, joint research, development and testing, and the exchange of research results and experience. Evaluating the S&T cooperation with China for the US, the report found scientific benefits such as providing access to large-scale research facilities not available in the US (in high energy or collaborative fusion physics, for example) and to knowledge in some fields where China has world-leading expertise, such as genetic engineering, areas of agro-biotechnology and earthquake sciences. However, perhaps more important than immediate scientific benefits, the evaluators found that S&T cooperation with China had an important role as a stabilising influence on the US-China relationship:

> *'It has provided an avenue for rational dialogue and communication regardless of other tensions in the often-volatile bilateral political relationship, while giving an influential segment of Chinese society – the science community -- a stake in maintaining a peaceful, constructive relationship with the U.S.'*[109]

Furthermore, the evaluators pointed out that one of the most important benefits for the US from S&T cooperation with China, was the inflow of highly skilled human capital from China:

> *'China is one of the leading sources for […] indispensable foreign brainpower without which U.S. research and development would slow, posing significant consequences for U.S. competitiveness and economic prosperity. The tens of thousands of Chinese students, scholars, researchers and skilled technicians who work in U.S. laboratories throughout the academic and private sectors make an enormous and vital contribution to U.S. research efforts across the entire scientific spectrum. While these students and researchers represent a powerful tool that the PRC can exploit to gather information on virtually every sector of U.S. science and technology development, they also form an important avenue for the U.S. in turn to exert influence on the PRC and advance social change in China.'*[110]

4.2 Japan and South Korea

In 2004, the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) presented a report on 'Strategic Promotion of Interim Science and Technology Activities'. This report emphasized the importance of strengthening science and technology cooperation with other Asian countries. More specifically, it stated that

> *Japan should strengthen its partnerships with China and South Korea, which have achieved significant progress in S&T development and economic growth over recent years, while pushing forward its support for ASEAN countries, which are expected to develop in the future, based on a long-term perspective.*

109 U.S. China S&T cooperation – Report to Congress. Executive Summary, 15 April 2005.
110 ibid.

Japan has a science and technology cooperation agreement with China. The 11th Japan-China Science and Technology Joint Cooperation Committee which was held in August 2005 in Beijing focused on Life Sciences and research exchange.

In January 2007, the ministers of science and technology from China, Japan, and the Republic of Korea issued a joint statement, announcing that the three nations will establish a mechanism to promote S&T collaborations among them. They agreed to establish a range of mechanisms for ministerial meetings, department chief meetings, and coordination meetings, in an attempt to facilitate collaborations. The following priority areas for collaborations were identified: environment, energy, infectious diseases, disaster prevention and preparedness, traditional medicines, traditional technologies, and new energy. In addition, the three countries agreed to work together to establish innovation parks.

5. Lessons learned for enhanced S&T cooperation with China

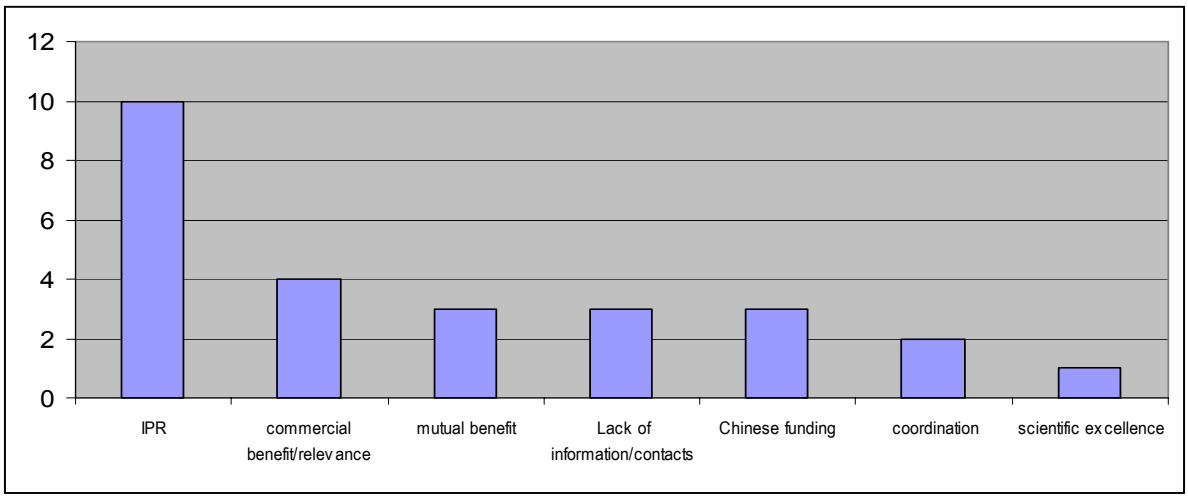
China's development is part of a fundamental change which is currently transforming the global distribution of knowledge resources. State-of-the-art technology and world class scientists are no longer the prerogative of the developed world. Countries, which in many aspects might still be considered developing countries are claiming increasing shares not only of world trade, manufacturing and raw material consumption but also of global knowledge resources, both when it comes to highly skilled labour and to corporate R&D. China is competing actively for these resources. China's emergence as a magnet for, and increasingly also a source of, frontier-level science and high technology puts demands on other countries and regions to formulate strategies on how to relate to it and other emerging giants within research and education. Even if the country still faces challenges in becoming a world leader in science and innovation, China offers significant opportunities for mutually beneficial research and education cooperation and trade of knowledge-intensive goods and services. China's opening to the world, the government's prioritisation of science and education and its desire to acquire knowledge and technology provide important opportunities, and vehicles for establishing cooperation on issues of global relevance such as environmental protection, corporate social responsibility and other issues.

However, the results of the most recent survey on the S&T cooperation with China carried out by the CREST Working Group in July 2007 and a following Working Group discussion give a clear indication, that the S&T cooperation with China is in general terms a challenging one. The most frequently listed challenge to S&T cooperation was policy concern on the protection of intellectual property (see Figure D.3). In addition to the responses from the survey summarised in the table, interviews with policy stakeholders in at least seven countries showed difficulties in interacting with the Chinese Ministry of Science and Technology (MOST) as a considerable obstacle for S&T cooperation with China.

As a general observation, there is a certain frustration or disillusionment on the European side with research cooperation with China and a view that it has led mainly to knowledge transfer from Europe to China without yielding significant economic or other benefits to Europe in return.

In the following sections, lessons learnt with respect to major S&T cooperation dimensions are summarised.

Figure D.3: Challenges in S&T cooperation with China



Source: Policy questionnaire on S&T cooperation with China – CREST WG on policies towards the internationalisation of R&D (Annex b)

5.1 Lessons learned regarding international mobility of Chinese and European students and researchers

Attracting Chinese students and researchers to Europe is important for several reasons. Firstly, it creates important ties and networks which can play a key role in future business interactions, but also economic and political relations between China and Europe, especially when considering the importance of personal contacts, or *guanxi*, in a country such as China. As an example, the fact that the recently appointed minister for science and technology, Wan Gang, spent 15 years studying and working in Germany, is seen as very beneficial for Germany and Europe. Secondly, Chinese students provide an important source of income, especially in countries which have introduced tuition fees, such as the UK. Finally, Chinese students potentially provide an important inflow of highly-skilled human capital, both as researchers and for future employment. A recent study which examined the role of overseas Chinese and Indians in the economic development of Silicon Valley found that both groups played a key role in the economic success of Silicon Valley's ICT cluster by contributing with networks, skills, and funding sources.[111]

However, several factors currently prevent Europe from reaping the full benefits of educating a growing number of Chinese students. In many European countries, it is difficult for Chinese to stay and work once they have finished their education. In interviews, Chinese students say that the possibility to stay and work in a country after graduation is an important determinant for their choice of where to study.

In some countries, such as Sweden, Chinese students are becoming an increasingly important way for Swedish universities of securing government funding. Thus, while education is free for students, universities receive a certain amount of funding per student for each student. As the number of Swedish or European students decline, universities seek to fill empty places with Chinese or other foreign students. At the same time, universities or countries lack the administrative resources or competencies to process an

111 Anna-Lee Saxenian, The New Argonauts, Harvard University Press, Cambridge, 2006.

increasing number of applications from Chinese students. Thus, embassies' visa sections are frequently already overstretched.

If countries and universities try to attract Chinese students in order to educate them for free, there needs to be a strategy for how a country wants to benefit from such an investment, unless one chooses to see the education of Chinese students as providing development aid. Such a strategy is currently lacking in many countries. Many European universities also lack a strategy for how to benefit from their Chinese alumni, in terms of future networks, branding and funding. Furthermore, if universities intend to target Chinese students as an important source of income or funding, they often need a much better idea of the expectations and needs of the Chinese students.

5.2 Lessons learned for enhanced S&T cooperation between European and Chinese S&T institutions

China is of strategic importance for Europe both in scientific, economic and political terms. Against this background and addressing the major challenges for S&T cooperation with China, the ultimate goal for policy makers is to provide an optimum frame to allow European institutions to gain optimum benefit from S&T cooperation with Chinese partners respecting at the same time Chinese interest.

More than anything else, right now China wants to acquire know-how and technology from developed countries. One of the approaches to gain knowledge is S&T cooperation at institutional level. China's thirst for knowledge should be viewed as something positive. With this regard, Europe's strength in science and technology is currently one of its most valuable commodities or assets in its relations with China. However, many decision makers are insufficiently aware of this strategic asset in their negotiations with China.

On the Chinese side, international research cooperation is traditionally a top-down process, with the Ministry of Science and Technology (MOST) identifying suitable topics and partners for cooperation both on the Chinese and foreign side. On the European side, research cooperation, tends to be a bottom-up process, often driven by researchers' individual interests and contacts. While this may be the optimal approach for research cooperation in general, in the case of China it might be worthwhile for decision makers in S&T institutions to reflect upon the need for a more strategic approach to research cooperation building on appropriate S&T policy measures. And looking from a policy perspective, rather than viewing research cooperation or knowledge transfer as a means to strengthening research excellence only, in the Chinese context it should be viewed as an important trump card in wider economic and political negotiations.

Along that line, it seems to be worthwhile to enter into an in-depth discussion on appropriate areas for closer policy coordination between MS/AS, which provide added value to individual MS/AS approaches towards policy framework for the S&T cooperation with China. With reference to the CREST survey on China, most MS/AS support to explore ideas for enhanced policy coordination, but notions over what should be coordinated and how differed widely. Whereas some countries advocate the exchange of information, others list IPR, implementing joint (multilateral) research projects – particularly in areas of global relevance – or establishing S&T laboratories as possible areas for coordination. Finally, some countries underline the importance of a general political or strategic coordination of S&T cooperation with China, with one country underlining the importance of a common foreign policy.

5.3 Lessons learned regarding Foreign Direct Investments

It is important to remember that multinational companies (MNCs) are the key drivers of globalisation of R&D, and this is very much true in China, where foreign corporate R&D is a key component in China's innovation system.

Assuming that companies are acting rationally and that they are establishing R&D in China not because the Chinese government forces them to but because they anticipate competitiveness gains, it would be counterintuitive or even harmful for European policymakers to attempt to hinder European companies from establishing R&D in China. Nonetheless, several policy challenges arise. Firstly, how can European countries ensure that this development has positive spillovers for knowledge creation, growth and employment in Europe? Secondly, how can European countries remain attractive as R&D locations for both European and foreign? Thirdly, European companies face considerable challenges when it comes to protecting their intellectual property rights (IPR) in China. This is a particularly daunting challenge for small and medium sized enterprises (SMEs) which do not have the financial or other means to defend themselves against piracy. Furthermore, the establishment of R&D activities in China requires large up-front costs and may take a long time to become a profitable operation, something which SMEs are much less likely to be able to afford than large firms. This partially explains why the phenomenon of outsourcing R&D, particularly to countries like China, has so far been completely dominated by large multinational firms. If it is important for firms' competitiveness to establish R&D abroad, including in China, then policymakers need to think about whether market or other circumstances are introducing a bias against SMEs which might warrant a policy response.

5.4 Techno-nationalism and protectionism – recent trends in China

After having welcomed and actively sought to attract foreign firms to China, several recent developments in China point to a tendency towards techno-nationalism or protectionism in China's economic, research and innovation policies.[112] One very concrete objective, formulated in the long-term plan, is to reduce the dependence on foreign technology to less than 30% compared with the current figure of 60%.

Criticism of the government's policy of attracting foreign R&D is also growing. Critics question to what extent there are positive spillovers from foreign R&D centres to domestic companies and research institutions. They claim that foreign research centres may actually be starving domestic companies of the best scientists and engineers, and criticise the government for putting too much emphasis on attracting foreign technologies, rather than promoting the growth of domestic technologies.[113]

Another important new instrument is public procurement. Government agencies are to prioritise innovative Chinese companies by buying their goods or services even if these are not as good or cheap as other companies (both Chinese and foreign).[114] A more ac-

112 For a discussion of techno-nationalism and neo-techno-nationalism, see, for example, Richard P. Suttmeier and Yao Xiangkui, China's post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism, NBR Special report 2004, National Bureau of Asian Research.

113 Science and Technology Daily, 'Whether China-based foreign-funded R&D institutions can be included in China's independent innovation system', 27 September 2006; see also Cao 2004 or Yuan 2006.

114 In the Report on the Work of Government presented at the 10th National People's Congress on 5 March 2007, Premier Minister Wen Jiabao stated that 'We will improve the mechanism for rewarding independent innovation and implement fiscal, tax and banking policies and the government procurement system to encourage and sup-

tive use of public procurement policies in this way could have significant implications for foreign companies' ability to compete with domestic firms for national and sub-national government contracts in, for example, telecommunications.[115] China is not yet formally bound by WTO commitments as it has not signed the Government Procurement Agreement (GPA), although the Chinese Government recently committed itself to initiate formal consultations to join the GPA by December 2007.[116] It remains to be seen how the emphasis placed on public procurement in the 15-year plan, as a means to strengthen domestic innovation, will be implemented in practice and how it will affect foreign companies chances to compete for projects in China.

The emphasis on independent innovation and on the reduction of dependence on foreign technology, combined with the announced use of public procurement to strengthen domestic companies and claims that foreign direct investment may have been detrimental to the innovative capacity of Chinese firms, has raised concerns among foreign firms in China of a backlash against them.[117] This has prompted a campaign by Chinese subsidiaries of European firms entitled 'We are a Chinese company too'.

China is pursuing a policy of developing national standards in several high-tech fields, particularly IT, telecommunications and biotechnology. Examples include initiatives to develop standards in wireless local area networks (WAPI) technology, third-generation mobile telephony (TD-SCDMA). As explained in Suttmeier and Yao (2004) and Kennedy (2006), this policy is driven both by an ambition to promote the development of internationally successful Chinese high-tech firms and by the desire to appropriate a greater share of the gains from globalisation and innovation. Thus, there is a widespread perception that foreign companies are earning unfair returns or profits, which according to some constitute 'monopoly rents', from owning, and excessively charging Chinese companies, for patents and royalties. China's market size lends its efforts to establish its own standards considerable weight.

Facing Chinese trends towards techno-nationalism and protectionism, the Member States should be active, both bilaterally, at Community level and within international fora, to prevent such tendencies putting China on a path towards isolationism.

5.5 Summary of lessons learned

Table D.3 summarises lessons learnt including good practice examples.

port independent innovation'. See also 'Lawmakers Call Government to Buy Domestic Products', Xinhua, 11 March 2007, http://www.10thnpc.org.cn/english/2007lh/202407.htm .

115 According to a study prepared on the behalf of the European Commission, in large procurement contracts, '50 % of R&D in big public procurement contracts has to be carried out by domestically controlled suppliers'. Working Group of National IST Research Directors' Forum, Pre-Commercial Procurement of Innovation, March 2006, p. 8.

116 John Liuzzi, 'Opening up the Chinese Procurement Market', International Trade Update May 2006, International Trade Administration, US Department of Commerce, www.ita.doc.gov .

117 Zhongping Lin, 'The Influence of MNCs upon China's Independent Innovation Capacity', China S&T Investment, May 2006, pp. 40-43.

Table D.3: Summary of lessons learnt for S&T cooperation with China

LESSON	GOOD PRACTICE EXAMPLE
Cooperation works best when mutual benefits are defined from the beginning; it is important to have a clear definition of goals on both sides and clear cooperation agreements which should cover duties, time schedules, finances, IPR, etc.	
Exchange of information and experiences and ad hoc coordination on specific issues among EU Member States and Associated States can prevent information asymmetries (i.e. the Chinese side knows which European countries it is negotiating with but the individual European countries don't know which other European countries the Chinese side is talking to) and also prevents European countries being 'played out against each other'	EU and Associated Countries' Science Counsellors' network which meets approx. 4-6 times per year, upon the initiative of the country which holds the EU Presidency, to exchange information about S&T activities with China Exchange of information on individual countries' interactions with China regarding cooperation on Traditional Chinese Medicine (TCM); organisation of a joint TCM study visit to gain a joint picture (at the initiative of the German EU Presidency)
While agreements with the Chinese Ministry of Science and Technology (MOST) are often necessary for establishing a basic framework for S&T cooperation, it is vital to have operational agreements with other institutions to achieve actual results. Furthermore, recent developments and analyses point to a potential weakening of MOST as the most central actor in China's innovation system. Thus, other actors should be considered in addition to or aside from MOST. Interesting cooperation partners are the Chinese Academies of Sciences, the National Natural Science Foundation of China (NSFC), the National Development Reform Commission (NDRC), the Ministry of Education, as well some Chinese universities.	Selected countries' cooperation agreements with National Science Foundation, Chinese Academy of Sciences, Innofund, etc. as a complement (and sometimes even alternative) to cooperation with the Ministry of Science and Technology (MOST) Irish cooperation agreement with National Science Foundation (2005) Spanish cooperation with Innofund
S&T cooperation with China should not only be viewed as an extension of national R&D activities, It also has bearing on the wider context of economic and political relations. If used well, it can provide a powerful vehicle for achieving other goals, such as addressing issues of global concern (pollution, ageing, epidemics, civil society) but also in terms of having significant relevance for innovation and businesses at home. S&T cooperation with China should be based on a carefully devised strategy with clearly defined goals and instruments for cooperation. Furthermore S&T relations with China should be embedded in a wider strategy for internationalisation / globalisation which should address not only research excellence but also economic and political interests	UK Strategy for International Engagement in Research and Development, presented by the UK Global Forum Science and Innovation Forum (in October 2006) China Strategy of the Norwegian Government (August 2007) and Norwegian White Paper on Research (2004)

Cooperation seems to yield good results when it targets concrete topics or 'real world' issues, or on issues of global relevance.	Examples of successful cooperation focused on 'real world' issues: Pollution (Norway), health (Norway; Finland), textiles (Czech Republic), welding research (Slovakia), soil conservation (Slovakia, Austria), information databases (Austria); environment (Germany, Finland), protection of cultural heritage (Germany)
Cooperation seems more likely to yield concrete benefits for the European partners when activities link research cooperation with business opportunities and/or commercial relevance. is linked to commercial interests of European countries' home industries. At the same time, the latter form of cooperation raises issues of IPR protection which need to be borne in mind and hopefully clearly addressed from the start	FinChi (Finnish-Chinese Innovation Centre): incubator for Finnish high-tech firms wanting to establish themselves in China; FECC (Finnish Environmental Cluster for China): involves both research cooperation and commercialization projects with a concrete goal to yield 5 business projects for Finnish industry Sino-French IT Lab (LIAMA), cooperation between CAS and INRIA, est. 1997, cooperation with French industry
Setting up successful R&D cooperation with China takes time and requires sufficient resources to be allocated to administer the cooperation and to maintain linkages. It takes time and continuity (and often the nurturing of personal relationships) to establish mutual trust.	Sino-French IT Lab (LIAMA), cooperation between CAS and INRIA, est. 1997 Sino-German Centre for Research Promotion, est. 2000 (cooperation between *Deutsche Forschungsgesellschaft* and National Science Foundation)

6. Conclusions: What should be done?

China's development is part of a fundamental change which is currently transforming the global distribution of knowledge resources. State-of-the-art technology and world class scientists are no longer the prerogative of the developed world. Countries, which in many aspects might still be considered developing countries are claiming increasing shares not only of world trade, manufacturing and raw material consumption but also of global knowledge resources, both when it comes to highly skilled labor and to corporate R&D. China is competing actively for these resources. China's emergence as a magnet for, and increasingly also a source of, frontier-level science and high technology puts demands on other countries and regions to formulate strategies on how to relate to it and other emerging giants within research and education. Even if the country still faces challenges in becoming a world leader in science and innovation, China offers significant opportunities for mutually beneficial research and education cooperation and trade of knowledge-intensive goods and services. China's opening to the world, the government's prioritisation of science and education and its desire to acquire knowledge and technology provide important opportunities, and vehicles for establishing cooperation on issues of global relevance such as environmental protection, corporate social responsibility and other issues. Finally, countries should work, both bilaterally and within international fora, to prevent tendencies towards techno-nationalism from putting China, and other countries, on a path towards isolationism or protectionism. Overall, China's aspirations to become a global knowledge center should be viewed as a positive development and an opportunity, rather than a threat.

In order to be able to design constructive and appropriate strategies for how to respond to the developments we are witnessing in China, and a number of other transition economies, it is concluded that Europe needs first of all a better understanding, among analysts and decision-makers both in the public and private sector, of modern-day China, its politics, economics and culture. Currently, there is a shortage of such expertise, in academia and in policymaking, both on national and EU level, particularly when compared, for example, with the United States.[118] Strengthening the analytical work will prepare the ground for European countries for knowledge based decisions on cooperation strategies incl. core objectives, priority themes and instruments.

A second conclusion is the present lack of monitoring and impact assessment of S&T cooperation policies as basis for optimising existing programmes and defining new initiatives.

As a third conclusion there seems to be much room for raising effectiveness and efficiency of independent national policy approaches through coordinated actions. This concerns both strategy development processes on MS´/AS´ and Community level, the definition of consistent and complementary frameworks for the S&T cooperation on national and Community level as well as the planning and the implementation of concrete policy measures.

6.1 Recommendations for MS/AS S&T cooperation policy towards China

The S&T cooperation policy towards China is defined and implemented by each of the Member States and Associated States in accordance to respective national objectives and interest. The analysis of different sources demonstrates the variety of national S&T activities with China on various levels, both policy driven or driven by scientific organizations, S&T institutions and individual scientists. Addressing the aforementioned conclusions and building on mutual learning exercises and discussions of the Working Group it is recommended to:

- arrange a regular exchange of information and – where appropriate - a better coordination of S&T activities with China among the various national stakeholders to avoid duplications of national activities and programmes.
- continuously monitor and regularly assess the impact of S&T cooperation with China and foresee an ex-ante evaluations jointly with Chinese partners before starting new activities.
- put emphasis on appropriate instruments for mobility on PhD and post-doc-level.
- coordinate S&T cooperation policies towards China with other policies to assure a comprehensive national strategy.

6.2 Recommendations for Community S&T cooperation policy towards China

Within the process of building the ERA, Community actions are aimed to add value to individual MS´ measures through raising the full potential of collaborative research, through providing a frame for achieving coherence and coordination of MS´ policies, through addressing particular topics of Community interest or of global dimension

[118] David Shambaugh, "The New Strategic Triangle: U.S. and European Reactions to China's Rise", *The Washington Quarterly*, Vol. 28, Nr. 3, Summer 2005, pp.7-25

complementing or amplifying MS´ S&T priorities and through avoiding that China can play potential EU partners against each other.

Along that line, for the particular case of the cooperation with China, strategic Community objectives should be defined and respective implementation measures should be agreed upon building among others on

- complementary measures within Community programmes,
- a (legal) cooperation framework towards China on Community level and
- targeted coordination of activities of MS.

It is recommended to:

- o establish appropriate Community instruments for the cooperation with China, which should among others
  - focus on topics of specific priority for EU-China cooperation
  - bridge the gap in size between the existing competitive collaborative research
- o schemes in the RTD Framework Programme and the bilateral national programs (mainly mobility schemes)
- o enhanced the mobility for PhD and post docs from Europe and China.
- o establish a regular high-level policy dialogue of the MS and the Commission.
- o arrange a continuous exchange of information and experiences among the MS on S&T in and with China.
- o strengthen and - where relevant - pool analytical competence on modern-day China (science and technology policy, innovation system, economy, etc.) and EU – China relations
  - increase analytical resources of the Community through targeted socio-economic and political research within FP7
  - monitor developments in China systematically through expanding the present ERA-WATCH activities.
- o provide the methodology and carry out impact evaluations of S&T cooperation with China at national and community level. These evaluations should focus on scientific, economic and political impact on national, Community and global scale.
- o establish and negotiate with China a proper Community framework for S&T cooperation and joint innovation activities including among others
  - protection and utilization of intellectual property
  - mobility of researchers
  - access to each others S&T infrastructures
  - setting up of (joint) S&T and innovation structures etc.)
  - public procurement rules
  - reciprocity through opening Chinese programmes for EU participation
  - counteract tendencies towards techno-nationalism both in China.
- o provide a targeted umbrella for coordination of MS´/AS´ activities with China in variable geometries in areas of global relevance like environment, climate, energy, health, ageing population on Community level; but also how to deal with topics where MS compete?
- o assure consistence and coherence of S&T cooperation with China with other Community policies areas (such as education, innovation/economy, foreign relations,

environment, energy, health) addressing community goals like
- attract junior and senior scientists from outside the ERA
- ensure sustainable global development (incl. environment/climate, energy efficiency, civil society, etc.)
- allow fair utilization of EU intellectual property in China and fair access of EU companies to Chinese markets.

o analyze human capital flows between China and Europe; develop scenarios how Europe can attract the best Chinese students and how Europe can maximize the benefits from educating large numbers of Chinese students and researchers.

Annex (e): Reflection of the CREST Working Group on the Green Paper 'The European Research Area: New Perspective'

Table of content

As a response to the European Commission's Green Paper 'The European Research Area: New Perspective' published on 4 April 2007, Annex (e) provides a reflection both on those questions which explicitly address the 'opening of the ERA to the world' and on those, which are to some extend linked to international S&T cooperation. It is a summary of different views rather than a full consensus and does not reflect national positions.

Main conclusions:

I. *An asset for building the ERA is a comprehensive European strategy for its international dimension targeting at measures at Community level and complementing national internationalisation strategies across various policy fields. For implementing the strategy, appropriate and efficient Community instruments need to be offered, which are build on an evaluation of existing ones and undergo continuous monitoring and regular impact assessment. Such instruments should give room for a coordination of MS'/AS' activities in variable geometries.*

II. *A major tool for the coordinated planning and implementation of a coherent international S&T strategy for the ERA should be a permanent strategy forum of a policy dialogue of the Member States, Associated States and the Commission. Third Countries could be invited to this forum to explore the potential of joint initiatives and for jointly addressing global issues in international research programmes.*

III. *Building on an assessment of previous and existing approaches to the cooperation with different groups of partner countries, targeted objectives and priorities as well as appropriate instruments should be agreed through a dialogue with the partner countries. Criteria for such a 'grouping' might be regional (neighbourhood countries), economic (industrialised countries and emerging economies) and political (developing countries) ones. Whenever appropriate, reciprocity should be an ultimate target of S&T cooperation.*

IV. *If the Member States share joint interest i.e. through addressing common policies or common European values, it should be considered for the EU to speak with 'one voice in multilateral initiatives'. Here, common European agendas should be agreed upon and the Commission should be provided with a mandate to represent the Community /if legally possible).*

V. *There should be an impact assessment of Community S&T agreements in order to ensure their efficiency. In addition, coordination, consistence and complementarity*

of S&T agreements at the level of Member States and the Community should be considered whenever appropriate.

VI. *Additional strategic areas of the international dimension of the ERA should cover to attract young research talents as well as experienced and top scientists and to foresee a strategic but flexible global approach to S&T infrastructure.*

1. Rationale and general reflections

With its Green Paper 'The European Research Area: New Perspective' published on 4 April 2007, the European Commission addresses the future orientation of the ERA as one of the corner stones to implement the renewed Lisbon strategy. Considered as one of the key assets of the ERA, the 'opening of the ERA to the world' is highlighted and a number of respective key questions are raised. Building on the outcome of a wide discussion process on the Green Paper, the Commission will propose a strategy for the further development of the ERA.

Since the strategy development process on the future international dimension of the ERA is a crucial one, the CREST Working Group included in its activities a reflection on the Green Paper. One should take note, that the following answers to the questions raised in the Green Paper are based on the analytical work, mutual learning and discussions of the Working Group and do not reflect official national positions. It is a summary of different views rather than a full consensus. To some extend, the points raised in the discussion refer to the Working Groups recommendations on enhanced coordination of R&D policies towards Third Countries between Member States and Associated States as they are summarised in chapter 5.5 of the report of the CREST Working Group.

Please note, that in addition to the specific questions, which are raised in part 6 'Opening the ERA to the World', some comments are made to questions 8, 15, 28 and 29, which are to some extend linked to international cooperation.

Before entering into the answers to the questions raised in the 'Green Paper', the following general comments are highlighted:

1. Activities at Community level should take note of the variety of activities at MS'/AS' level. They should follow the principle of subsidiarity and should add particular value for implementing the concept of a 'wider ERA', which is open to the world.
2. To have a common and solid ground, it is urgently proposed to set-up a consistent wider strategy for the international dimension of the ERA targeting at measures at Community level across various policy fields, which foster or benefit from international research cooperation and provide an appropriate frame for respective actions of the Member States (coordinated or not).
3. The funding instruments offered for international cooperation throughout the 7th RTD Framework Programme enable the participation of Third Countries in more or less all activities. But for the time being the impact and the efficiency of these 'opening up' is not proven. There should be an assessment as part of the mid-term evaluation of the Framework Programme, if it proves necessary an adaptation of the instruments and a continuous monitoring of the international activities.

4. In general, before new programmes and instruments will be established existing instruments should be thoroughly evaluated and assessed in order to improve them where necessary and possible. Room for variable geometry should be given as well as supportive instruments for it.
5. According to the Green Paper the main objectives of international research co-operation are stability, security and prosperity. Sustainable development in its broad meaning (environment, economy, society and culture) should be added to these objectives. These objectives should be fully reflected in the respective Community instruments. In line with these objectives, new activities at Community level should be launched especially in the field of social sciences related to Third Countries on issues with a European impact (such as international migration, attitudes of religions and religious movements, regional development, terrorism).

2. Reflections on questions on how to 'open the ERA to the world'

Question 30: How can the European Commission and MS work together to
- ***i. define priorities in coordination with other dimensions of external relations***
- ***ii. ensure the coordinated and effective use of instruments and resources***
- ***iii. speak with one voice in multilateral initiatives?***

a. Creating a permanent dialogue forum for policy stakeholders (high-level officials) from Member States, Associated States and the Commission

For the coordinated planning and implementation of a coherent international S&T strategy for the ERA building on consensus and aiming at mutual benefit of the Member States it is proposed to establish a strategy forum on international cooperation, which is supported in an adequate manner. The particular mandate should cover among others:

- to work out and update general and specific cooperation objectives based on national interest
- to recommend priorities (in terms of partner countries and themes), centred around the specific needs of collaboration with neighbouring, developing and industrialised countries
- to monitor the implementation of respective Member States and Community actions across relevant programmes to enhance their consistency and to allow better coordination between the different stakeholders
- to propose common initiatives in multilateral organisations to allow speaking with 'one voice' whenever appropriate.

Referring to this mandate, it becomes clear, that the focus of the strategy forum would go far beyond the Framework Programme and a respective dialogue structure does not exist. CREST might be a most appropriate option to set-up this forum.

b. Ensure a consistent framework for cooperation with Third Countries across different policy areas, which is built on common policy objectives of the Member States

From the particular perspective of S&T cooperation with Third Countries, it is

recommended to design policy measures in consistency with other policy areas like education, economy, security, environment, health etc. At Community level, for planning and implementing the annual work programmes of FP7, other instruments should be considered by the Commission and the respective Programme Committees as well (with emphasis on LLL, Erasmus mundus, CIP, development cooperation like ENPI and DCECI) to ensure the complementarity of actions. For this, a knowledge base on the activities in different Community programmes needs to be provided.

Within the scope of the up-coming mid-term evaluation of FP7, the Commission should analyze the impact of the present cooperation instruments with Third Countries including their interaction with other relevant Community instruments.

It is recommended to improve the Commission's internal coordination of international S&T cooperation with the other relevant instruments.

c. **Exchange information on policy measures of Member States and the activities of the Commission for S&T cooperation with priority partner countries as a basis for enhanced coordination**
For priority partner countries it is proposed, to ensure a regular exchange of information between Member States and the Commission (different DGs). Here a respective inventory of objectives, instruments and activities could be established and updated based on a standard reporting tool. An additional efficient tool could be a living network of Member States embassies and EU-Delegation in the partner countries, which is moderated by the EC.

d. **Provide optimum Community instruments for a coordinated 'Opening of the ERA to the World' and ensure optimum dissemination of results**
Community instruments like ERA-NETs and INCO-NETs seem to be appropriate to establish a continuous dialogue of political stakeholders, to identify common trans-national interests and to implement coordinated measures. However, it is recommended to include these instruments in the *mid term* evaluation of FP7 and identify room for their optimization acknowledging the particular needs of cooperation with Third Countries. Also the instrument of smaller support activities (previous SSAs) should be further encouraged. The underlying principle for coordination of Member States' international S&T cooperation should be a voluntary basis following the principle of variable geometry

However, appropriate measures should be taken to enhance the dissemination and exploitation of results developed under these projects, e.g. in form of a specific web-based inventory of EU-coordination activities, 'International RTD cooperation days' in Brussels (fair) or road shows, which disseminate the findings also to MS/AS, which were not participating in the projects.

e. **Strengthen the role of the European Commission in multilateral initiatives based on consensus building among the Member States** (see also question 35)
Building on previous success stories and aiming at increasing the European impact in multilateral initiatives, the role of the EU (represented by the Commission) in international organisations and in the dialogue with regional organisations should be strengthened. A prerequisite would be a mandate provided by the Member States based on consensus. However, it will neither be desirable nor possible in all cases for the EU to always be unanimous, or in other words 'to

speak with one voice'. Therefore the organisation of European representation will have to be examined on a case by case basis.

f. Linking the analytical capacities of the European Commission with those of the Member States / Associated States

It is also proposed to ask the JRC/IPTS for providing a continuous knowledge base on priority partner countries as well as additional major present and up-coming competitors of the EU. In addition, by appropriate means an indicator based monitoring processes for S&T cooperation with Third Countries on Member States and Community level should be set-up. Here, the activities within relevant ERA-NETs, up-coming INCO-NETs and other relevant EU projects should be considered.

Question 31: How can the European Commission and the MS work together to explore the potential of initiatives for international research programmes on global issues involving Third Countries as well?

a. Identify appropriate subjects for a coordinated approach at Community level

Such a dialogue involving the Commission is appropriate in such cases, were the Member States share a common interest (like Climate Change, Energy, emerging diseases) and/or were Community instruments explicitly address global problems.

b. Establish a dedicated strategic dialogue (see 30.a) with Third Countries' stakeholders

Strategic discussions on priorities for (joint) initiatives towards global issues to be implemented through international research programmes require an enhanced policy dialogue between Member States, Third Countries and the Commission. This could be implemented through inviting Third Countries to dedicated discussions of the strategy forum on international cooperation (30.a).

For such a dialogue, it should be distinguished between various groups of Third Countries in order to define their particular role as 'target' of such (joint) S&T initiatives and/or possible contributors to implement new initiatives.

As a result, joint initiatives should also be addressed to multilateral organisations like OECD and UN bodies like UNESCO with 'one voice'.

c. Make optimum use of Community instruments for joint priority setting and implementation of joint initiatives with Third Countries

The INCO-NETs (at policy dialogue level), the ERA-NETs (for setting up joint calls on priority topics) and art. 169 for setting up joint programmes have proven to be (like SEE-ERA.NET and EDCTP) or seem to be appropriate under the assumption, that the partner countries are involved on equal footing and – if appropriate – on reciprocity basis. In particular for the 'international' ERA-NETs this needs to be better ensured.

For implementing joint S&T activities with Third Countries towards global issues, collaborative research within the Community RTD Framework Programme should address respective priorities through targeted calls and SICA-type activities as well. Such topics should jointly be defined with the Third Partner Countries.

In addition, the systematic promotion of international cooperation via the mobility of high qualified experts appears to be a key basis for enabling the development of global answers. Against this background, the Specific Programme 'People' should be utilised for targeted 'mobility' actions of EU and Third Countries researchers.

d. Explore options for setting-up multilateral funding schemes on global scale

International research programmes would be properly implemented on a multilateral basis or through international organisations. However, in many cases, there is no adequate setting for managing multilateral programmes. Therefore, appropriate procedures and structural arrangements need to be explored for pooling various funding national instruments in variable geometries on global scale including contributions from multilateral bodies (like the European Commission) and other donors.

Question 32: How should S&T cooperation with various groups of partner countries be modulated to focus on specific objectives? Should complementary regional approaches be explored?

a. Analyze good practice and learn lessons
For the time being the Monitoring Committee for the Mediterranean Countries (MoCo) is considered a good practice model in this respect. The 'Steering Platform on Research with the Western Balkan Countries' is on its way also to become more and more effective. A different approach towards dedicated funding actions at Community level addressed to a particular region is INTAS. These examples should be evaluated to draw conclusions for further actions.

b. Define appropriate target groups of partner countries
Particular importance should be given to the countries of the neighbourhood regions (see question 33). An additional regional approach is recommended in those cases, were particular synergies of regional cooperation are to be expected building on common interests and joint initiatives of the countries of the respective 'region' (BSEC, ASEAN, Mercosur, African Union/NEPAD).

Dedicated approaches for various target groups of partner countries should be considered not only on a regional basis. Another important focus should be put on the cooperation with non-associated highly industrialised countries (USA, Canada, Japan) and dynamic economies (Russia, China, India, South-Korea). Another target group are developing countries.

Based upon this regional and economical differentiation, a further targeted fine-tuning by scientific themes (either scientific strengths of developed countries or needs of developing countries) should be undertaken.

c. Identify appropriate priorities for target groups of partner countries
The S&T cooperation should be goal-oriented both in terms of establishing priorities among partner countries and defining areas of cooperation. Such priorities can only be established by differentiating among the various groups of partner countries on the basis of their competitive capabilities, social needs and of distinguished topics addressing common interest or particular other needs of a group of partner countries. The priorities needs to be jointly defined with the respective (group of) partner countries. I.e. for non-associated highly industrial-

ised countries and dynamic economies the focus should be on strategic research areas and the principle of reciprocity should strictly be followed. Particular joint measures should be addressed to global problem solving. For developing countries it is recommended to focus on problems with impact on Europe in social or economic terms and on global challenges like the strategy for sustainable development and the Millennium development goals.

d. Establish a set of instruments to cover different needs of cooperation with the various groups of Partner countries

Different groups of partner countries need different philosophies and instruments of cooperation. The EU must use multiple tools in its instruments to address the complex international reality. Complementary but consistent approaches within the RTD Framework Programme and other Community programmes (Development Cooperation, Erasmus mundus, LLL, CIP, …) addressing Third Countries should be ensured. Appropriate instruments need to be jointly identified with the respective partner countries.

For non-associated highly industrialised countries and dynamic economies is room for further enhancing appropriate instruments for collaborative research within the RTD Framework Programme like coordinated or joint calls and the integration into European technology platforms. In addition, a targeted Community framework for a coordination of activities of Member States, Associated States and the third partner country(ies) should be provided. We recommend particular tenders for (thematic) ERA-NETs with participation of the partner countries on equal footing.

For strategic strengthening of the S&T cooperation with developing countries a stronger coherence and coordination with development policies is highly recommended (e.g. a 'global INCO- or ERA-NET'). Such a coordination across different policies should aim at contributing to country specific or global development goals through targeted S&T activities (i.e. through thematic calls like SICAs) and at making optimum use of the instruments of foreign assistance addressed to developing countries (like DCECI) for raising the capacities of national and regional S&T systems of the partner countries. Thus, the focus should be on research for development as well as on structural initiatives to upgrade the S&T systems of developing countries according to good European practice and standards. The latter objective would prepare a sustainable ground for future S&T cooperation following the excellence goal. With this respect it is proposed, to set-up a dialogue between the Member States and the Commission on how national and Community policies towards developing countries could be better linked to S&T policies.

A further questions, which needs further consideration in the case of the group of developing countries is, how the available RTD Framework Programme can be used for the particular cooperation goals without diluting the objective to increase Europe's competitiveness.

A horizontal issue relevant for the cooperation with a number of Third Partner Countries is to lower the mobility barriers towards the EU and its Member States by both simplifying the administrative procedures and funding mechanisms for non- European partners.

Question 33: How can neighbouring countries be best integrated into the ERA as part of the Neighbourhood Policy?

a. Offer each neighbouring country a bilateral dialogue process

For the cooperation with the neighbourhood countries it is proposed to offer each country a bilateral dialogue process on S&T, which should be integrated into the established dialogue as integral part of the neighbourhood policy and which should complement existing multilateral dialog platforms (MoCo, BSEC) and the up-coming INCO-NETs with the Mediterranean Region and Eastern Europe/Central Asia. If necessary, the option for topping-up the up-coming INCO-NETs (INCO-NET EECA and MIRA) as a response to particular emerging needs for an enhanced knowledge based dialogue and for promoting the *Acquis Communitaire* and Community instruments in the neighbourhood countries should be foreseen.

The dialogue process involving interested Member States and the Commission should identify priorities for joint action and respective (joint) implementation instruments.

b. Coordinate policy measures between Member States and the Commission towards strategic neighbouring countries

Policy measures of interested Member States and the Commission towards strategically important neighbourhood countries with particular cooperation potential like Russia, the Ukraine and Egypt should be better coordinated. Here, targeted country specific coordination activities at Community level (most prominently ERA-NETs) should be offered ensuring participation of the partner countries on equal footing.

c. Ensure an optimum coordination between different cooperation policies at Community level

Acknowledging that the ERA and the Neighbourhood Policy (ENP) originally aiming at very different targets, it should be ensured, that the Neighbourhood Policy Instruments (ENPI) complement the RTD Framework Programme and synergies are explored to a maximum extend. That includes a stronger role of S&T within ENPI implemented through the dedicated Action Planes towards individual partner countries. Here, emphasis should be given to capacity and institution building activities in order to pave the way for better participation in the RTD Framework Programme. A pre-requisite is to raise the awareness of policy stakeholders in the neighbouring countries for the importance of S&T.

d. Make the best use of Community instruments to fully integrate the neighbourhood countries into the ERA

The integration of interested neighbouring countries in the ERA should be promoted through the Framework Programme and other relevant Community programmes (CIP). Special joint efforts with the neighbourhood countries should be foreseen for participation in all areas of the RTD Framework Programme. Through a specific Dialogue Process (i.e. joint thematic working groups) topics for SICAs should be identified to substantially integrate these countries in collaborative research of the 'Cooperation' programme. Additional emphasis should be given to the integration in European Technology Platforms. The instrument of 'Coordinated calls' should be further developed with emerging economies in the neighbourhood regions, most prominently Russia in order to ensure reciprocity within joint activities.

Within the 'People' programme it is recommended to allow mobility of researchers from neighbouring countries with a specific and efficient 'return' system.

The neighbouring countries should also receive particular attention within the further development of the European Research Council and its activities implemented through the 'Ideas' programme. Building on the experience of INTAS, in particular the Eastern European neighbours have particular academic strengths in fundamental research.

As regards the 'Capacities' programme apart from particular emphasis on the neighbourhood countries within coordination instruments on international cooperation (INCO-NETs, BILAT, ERA-NETs), it is conceivable that the participation of neighbouring countries is supported by specific measures on strengthening the 'Research Potential' as provided in FP7 for the new Member States. It is also conceivable that such supportive measures can be financed by the financial instrument for cooperation with ENP partners (ENPI) according to (c).

For an enhanced participation, there is a strong need for awareness raising and information dissemination in the partner countries to better prepare non-EU partners. With this regard, the integration of the neighbouring countries in the European Network of mobility Centres (ERA-MORE, European Research Area – Mobile Researchers) should be foreseen. For preparing a better ground, the capacities of the information and consultancy structures in the neighbouring countries (most prominently the NCPs) should be substantially raised and respective options within ENPI should be explored.

An association to relevant Community programmes (The RTD Framework Programme in a first row) should be an ultimate goal. Referring to the particular needs of developing an adapting the S&T systems of the neighbourhood countries what requires substantial national investments, fair conditions should be offered for defining the costs for such an association.

e. Involve the neighbouring countries in the development of European S&T infrastructure

A major pillar of the ERA is an adequate S&T infrastructure allowing cutting-edge research. Therefore, S&T infrastructures in the neighbouring countries should be taken into account and – if appropriate - be involved in the strategic development of European S&T infrastructure.

Question 34: How can EU's bilateral S&T agreements be made more effective? Are there alternative or complementary instruments that can be used, such as joint calls for projects, involving where possible the MS?

a. Evaluate the impact of S&T agreements at Community level

Some of the present S&T agreements at Community level seem to be not very effective. The demand for an increase in effectiveness is therefore justified. An impact evaluation is proposed in order to prepare the ground for optimising this instrument. In future, in considering the extension of existing agreements or preparing new ones, they should undergo a very thorough scrutiny.

If appropriate, the impact of Community agreements should be further increased through raising their substance to become an effective reference model for the Member States.

b. Ensure coordination, consistence and complementarity of S&T agreements at the level of Member States and the Community whenever appropriate
Although there are already mechanisms in place (through the Council), it is proposed, to ensure a stronger active participation of the Member States in the planning of new and the extension of ongoing S&T agreements at Community level as well as in their implementation process. An appropriate instrument could be to implement this coordination by the proposed strategy forum on international S&T cooperation. In addition, it is proposed to foresee consistency and complementarity of the legal framework for S&T cooperation at Member States and Community level. I.e. issues like IPR, privileged access for researchers to visa, access to scientific infrastructure could and should be dealt with at Community level, whereas specific priorities and instruments should be agreed upon at bilateral level.

c. Implement S&T cooperation through complementary instruments based on reciprocity
For reflecting on instruments for S&T cooperation with Third Countries it is imperative to study the experiences of the ongoing coordination activities addressing S&T policy measures of the Member States towards Third Countries – CO-REACH for China, SEE-ERA.NET for the Western Balkans and EU-LANEST for Latin America – which are supported by the Commission.

Addressing the RTD Framework Programme, targeted joint calls or coordinated calls for research projects with industrialised countries and emerging economies on specific subjects seems to be most appropriate. This instrument might also be explored with less developed economies. The joint activities with the Western Balkan Countries within the SEE-ERA.NET might serve as best practice model in this respect.

In general terms, the present Community ERA-NET scheme should be further developed to better meet the needs of coordinated international S&T activities at programme level together with Third Countries. It proved to be essential to involve the partner countries on equal footing. In addition, it is recommended to provide top-up funding for ongoing European ERA-NETs to set incentives for integrating Third Countries in up-coming joint calls and to implement activities to produce additional output based on needs and demand emerging from the strategic discussions and decisions of the ERA-NETs or INCO-NETs.

Complementing the existent ERA-NET scheme, one should think about introducing a flexible funding instrument for smaller scale coordination activities of MS', AS' and Third Countries in variable geometries.

In addition, experiences from bilateral cooperation schemes instruments show the effectiveness of enhanced mobility of experts, mutual access to S&T infrastructure and of accompanying measures like workshops and joint S&T training activities. The challenge is to study good practices and enlarge the scale of application of such actions in a more coordinated way.

Question 35: How can common European agendas for S&T cooperation be promoted in multilateral organisations and agreements as well as with regional organisations (ASEAN, Mercosur)?

a. Identify subjects for common agendas aiming at European added value
A continuous consultation process among the Member States and the Commis-

sion should be set-up through the proposed strategy forum for identifying the common ground to jointly address global issues and regional needs in multilateral organisations. Such a consultation is aimed to identify priorities of common interest or even common policies, to prepare common positions and – if relevant - to propose appropriate Community instruments contributing to implementing global multilateral initiatives.

Here it should be considered, that it will neither be desirable nor possible in all cases for the EU to achieve unanimity in an international context. As a consequence, the organisation of European representation will have to be examined on a case by case basis to identify subjects, where no vital national interests might hinder such a joint approach.

b. Identify relevant multilateral or regional organisations
For designing a global framework for S&T and for defining and implementing global S&T priorities following common European agendas, appropriate organisations should be identified to put forward European initiatives. Along that line, Europe should play a leading role most prominently in the OECD and at UN and G8-level as well as toward regional organisations like BSEC, ASEAN, MERCOSUR, the African Union/NEPAD-AMCOST.

c. Define the role of the European Commission to present common agendas of the Member States
Based on a unanimous agreement of the Member States, a representation at EU scale by the Commission should be foreseen. On a case by case basis it would have to be examined, which role the Commission is legally allowed to play, depending on the statutes of the respective organisation. In such cases the Commission should regularly report to the Member States on their activities.

3. Reflections on other issues related to the international dimension of the ERA

Question 8: How could we increase the numbers and quality of researchers in Europe by attracting young (international) research talents …?

It is an ultimate goal of the Member States to raise the attractiveness of their national S&T systems. These are the main pillars, on which European attractiveness is build on. However, Community measures could further increase this attractiveness building on the scientific value added by implementing the ERA concept.

a. Set-up a policy dialogue at Community level on the attractiveness of the ERA
Such a dialogue should aim at identifying strengths but threats at Community level and should result in policy measures to overcome the later. Such policy measures at Community level should address among others:
- easier access to research facilities and institutions in Europe incl. the openness of Universities in integrating external experts and promoting mobility
- easier access to the European labour market
- free mobility of foreign researchers throughout the ERA based on 'grant continuation' (money follows the researcher)
- establishing joint but unique European S&T infrastructures

b. Analyze present competitive advantages of major competitors
Either building on the skills of the IPTS or through a call for tender a study

could be launched on the particular strengths of major competitors (US, Japan, China, …) and respective policy measures to raise national attractiveness to foreign researchers.

c. Implement marketing campaigns at Community level as an umbrella for respective initiative of Member States
Joint campaigns have the particular potential to demonstrate the scientific strengths of Europe as a whole with its numerous Centres of Excellence and its variety of unique or highly specialised S&T infrastructures.

d. Ensure attractiveness of Community instruments addressed to inward mobility
Here, complementing individual mobility the support to advanced research and training networks (and its opening to young researchers of Third Countries) will very likely contribute significantly to meet the above objectives. In addition, the awareness for the existing return fellowships for young scientists from developing countries within the 'People' programme should be further raised.

Apart from the 'People' programme also Erasmus-Mundus and the Life-Long-Learning Programme should be considered to attract young academicians from Third Countries, which might enter a research career in Europe at a later stage.

As a general remark, facing aging societies, flexibility-caused patchwork careers in S&T and increasing productivity, it is recommended to introduce appropriate schemes and to consider the above reflections for attracting experienced and top researchers (not at least from the USA) to work in Europe as well. Here, existing mechanism at MS level need to be taken into consideration.

Question 15: Should a global forum on research infrastructure be created, involving Third Countries and international organisations, where European speaks with one voice?

No, because:

a. first priority should be given to implement the ESFRI roadmap

b. it is expected that a negotiation processes including Third Countries would be even longer and more complicated.

However, complementing the ESFRI Roadmap it is proposed to:

c. ensure access to important non-European S&T infrastructures,

d. open European infrastructures to countries with a less developed S&T system,

e. consider the joint establishment of particular S&T infrastructures of global importance with leading industrialised countries (USA, Japan, Canada) and dynamic economies (Russia, China, India, South-Korea) on a case by case basis,

f. set-up a dialogue process with the partner countries on the strategic development of S&T infrastructures (building on and enlarging the ESFRI Roadmap) with (potential) Accession Countries and the countries of the Neighbourhood regions.

g. contribute to the up-coming 'Global Research Dialogue', as it was discussed at G8 and OECD level, which addresses large-scale research facilities as well. Going beyond the OECD, it is welcomed to include non-OECD countries such as China and India in such a dialogue.

Question 28: On such societal issues of … global dimension, how could principles and modalities be established for joint programming of research, involving all stakeholders (research institutions, business, civil society) and bringing together funding from EU, (other multinational), national, regional, business and philanthropic sources?

On such issues a case by case approach seems to be much more practicable than a world wide common procedure. The principles should be defined in such a way that a good balance might be reached between the ambitious objectives to be met and the need to keep the necessary flexibility associated to the diversity of priorities in different countries.

This could, for instance, be implemented as a 'donor bourse' for matching funds for specific projects which have been identified by the EC in dialogue with developing countries. There the focus should be trans-disciplinary, i.e. not limited to research but open to complementary capacity and institution building measures.

Question 29: Should the European Community seek membership of intergovernmental research organisations?

Yes, due to the impact of intergovernmental research organisations like JINR (Dubna, Russia), ISTC and STCU for global and regional problem solving and the setting and implementation of respective research agendas, a discussion process on the role of the EU and its Commission in relevant organisations should be set-up through the proposed strategy forum. Wherever appropriate – meaning on a case by case basis - the Commission should represent the EU based on previously agreed common positions of the Member States. In such cases the Commission should regularly report to the Member States on their activities.