THE ROLE OF INTERNATIONAL COLLABORATION IN THE FRAMEWORK PROGRAMME. EXPERT ANALYSIS IN SUPPORT OF THE EX POST EVALUATION OF FP6

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CONTENT

ASSESSMENT AND WAYS FORWARD IN A NUTSHELL

5,6% of all partners in FP6 came from outside the EU Member States, Associated Countries and Third Countries, receiving 2,6% of the FP6 budget. International collaboration had a dual logic. International partners could participate as integral part of RTDI funding to enable multi-lateral (as opposed national in Member States Programmes) teams to tap into specific knowledge as needed for concrete project work. Further, they could participate in the programme INCO that was dedicated for participants from four global regions of non-advanced or emerging countries within thematic corridors co-defined following regional strategies of the EU.

The overall foreign participation is very modest as regards advanced countries, FP6 has not been a major means to tap into global excellent knowledge. The mobilisation of partners from dynamic growing economies (mainly CN, IN, BR) took off in the right direction but still seems sub-critical given the scientific and economic potential of those countries and the value of lasting network relationships. Based on a recent evaluation, INCO had a positive impact on the third country participant's networking and capacity building and provided access to forefront knowledge, but data and analysis is missing as to the relative meaning of INCO for the cooperation activities of INCO countries more broadly. INCO filled gaps in the EU development policies, although for the EU development and aid policy INCO does not have a high priority. .

Based on the developments in FP6, the FP in the future needs to maintain the possibilities to fund access to the skills and knowledge needed for successful projects and focus on the strategic support within the grand challenges approach should it materialise. The FP in the future should also intensify efforts to team up with growing economies and should continue mobilising funds that are geared to support regional and developing policies, but these funds could be pooled with those DGs responsible for those policies.

The design and direction of the extra-European Marie Curie schemes in FP6, both inward and outward, went in the right direction (especially regarding the funding of a return phase). The numbers of outgoing fellows that went to emerging regions of the world appears low, similar to the collaboration projects with those countries, here more emphasis and additional incentives would have been helpful.

The major achievement of FP6 lies in mobilising new forms of coordination geared towards international collaboration, both industry driven (ETP, now JTI) and driven by national programme owners / mangers (ERA-Net, now INCO-Net). The EU as latecomer and still minor player in international RTDI arenas has laid the seeds for making a real difference. The main pillar of EU support of international collaboration in the future should be to facilitate and help to coordinate activities of Member States (especially smaller ones) and internationalising actors within them, giving Europe a face and actor capabilities globally.

1 INTRODUCTION

In September 2008 the Commission has issued a new communication on International Collaboration in Science and Technology. This communication tells how important international collaboration is for the EU, and it tells us that there is a long way to go until we have a fabric of instruments and approaches across Europe that best captures the broad potential benefit for international S&T co-operation. To go forward and establish a strategy and framework that is most beneficial for science and innovation in Europe and beyond, it is indispensible to draw lessons from the recent past. Therefore, we need to discuss the role of FP 6 in the global generation of scientific and technological knowledge and the role the international dimension can play for the FPs and the build up of ERA. We should understand this exercise as an opportunity to draw lessons for an ever more complex dimension of governing and enabling global S&T, its benefits for Europe and its contribution to solve global problems.

This paper analyses the role of international collaboration within Framework Programme 6 as a background review for the Ex Post Evaluation. International collaboration is defined as collaboration between partners of EU Member States and countries associated to FP 6 on the one hand and extra-European and non associated partners on the other hand (the latter will be labelled third countries or international partners in this paper). This definition is important, as from a national perspective international in fact means intra-European as well, and comparative statistics often miss this point.

The review is **not** an evaluation, and it cannot rely on primary survey data. Many of the questions would need a thorough investigation with specific questions to be answered by participants and stakeholders. Further, the review needs to be selective and will thus focus on major aspects that are perceived as important, much more could be analysed. For example, I only touch aspects of internal governance and management as regards international collaboration. [1]

The review focuses on the following aspects, the order of which also indicates the structure of the report:

- drivers and motivations of collaboration in FP 6 (section 2)
- main instruments used (section 3)
- contextualising the international activities of the FP within global trends of collaboration, the position of Europe and impacts of collaboration (section 4)
- relevance for actual research (participation analysis, section 5)
- relevant governance changes within the ERA concept that is linked to FP 6 (section 6)
- major conclusion and lessons learned (section 7); **for the quick reader section 7 ca serve as an executive summary**.

[1] A separate study to understand the meaning of FP 6 research on a global scale is underway that will cover many of those aspects.

2 OBJECTIVES OF FP6 IN LIGHT OF DRIVERS AND MOTIVATIONS FOR INTERNATIONAL COLLABORATION

2.1.1 Drivers and motivations for researchers and policy makers in general

To understand the drivers and objectives for the international activities in FP 6 we start with a brief outline of motivations of researchers and firms to collaborate and the drivers of policy that supports it more generally.

Motivation or researchers

Discussing policy for international collaboration it is important to distinguish between the **motivation of researchers and firms** to collaborate on the one hand and the **policy motivations** to support collaboration. While the latter in general supports the former, there is a whole range of additional policy divers that go beyond the science and market oriented drivers of research organisations, firms and individual researchers. Systematic data for the specific motivations to collaborate with extra-EU partners within FP6 is not available at that point, the list below thus serves to give the context and variety from the perspective of researchers and firms.

The following list is more or less consensual in the literature on international collaboration although the relative importance of those motivations differ slightly (among the more recent publications, see for example Georghiou 1998, Archibugi and Iammarino 1999; AD Little 2005; Wagner and Leydesdorff 2005; UNESCO 2005, Edler 2007; Edler et al. 2008):

- access to and acquisition of leading edge and complementary know how,
- sharing of the costs and risk with international partners, especially when large infrastructures are needed for basic science (e.g. particle accelerators) or product development (e.g. international telecommunication networks),
- finding solutions for complex scientific and technical problems that could not be solved with domestic resources alone,
- access to funds from foreign institutions / programmes
- access to skilled individuals that might have an interest in pursuing opportunities for research in another country (recruiting),
- access to endemic research subjects, such as natural or social phenomena, etc. which are limited geographically,
- a desire to influence regulatory regimes or standards.

Companies and application oriented institutes, while sharing many of those goals, use R&D **collaboration also to facilitate or prepare access** to foreign clusters and markets, in which case the collaboration tends to aim at better understanding the characteristic of local players and demand, and they may seek **reputational spill-overs** from joint research with partners of prestigious international standing.

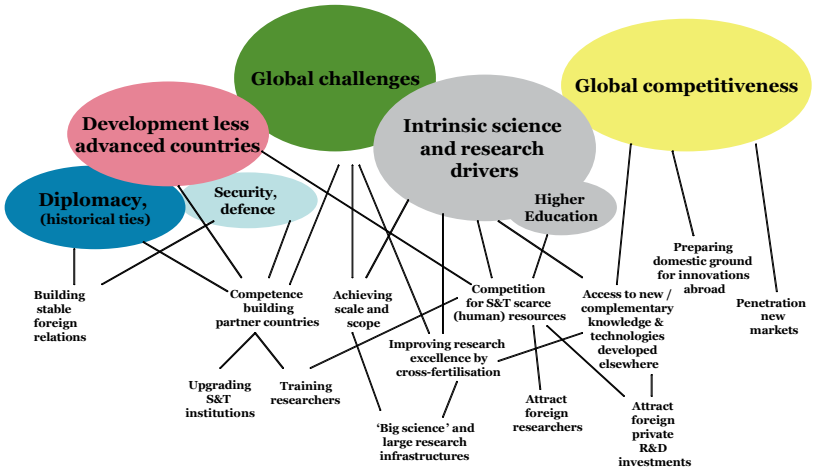
Policy drivers

A **second dimension** is **policy to support** international collaboration in S&T. Here we can draw on a current study that takes stock of policy drivers of national OECD governments (Boekholt et al. 2008). Policy drivers have become broader in recent years along with the more systematic attempts of national governments and large funding and research organisations to design internationalisation strategies (Edler 2007, Boekholt 2008, CREST Working Group 2007, 2008).

We can distinguish between a **'narrow S&T co-operation paradigm**' whereby policy tries to support scientists and firms in their international activities, driven by their individual motivations, as explored above. In addition, there are a range of drivers that go beyond S&T support. In such a '**broad S&T co-operation paradigm'** other non-science policy objectives come into play and interact with the 'intrinsic' science oriented objectives and S&T co-operation becomes a means to reach other policy ends. These non-science policy objectives are moving more to the foreground and provide the research policy community with both opportunities and challenges.

The following figure illustrates the main policy domains that are mentioned as key drivers in national strategies. One out of many examples, but maybe one of the most elaborated ones, is Germany, where a four-pillar strategy for international collaboration has been designed recently, combining (i) co-operation with global leaders (science excellence), (ii) international exploitation of innovation, (iii) intensifying international co-operation with developing countries, (iv) assuming global responsibility and mastering global challenges (Matthes 2008).

Figure 1 Main sets of drivers behind the development of international S&T co-operation policies



Source: Boekholt et al. 2008

To complicate the picture, we find more and more pronounced internationalisation strategies of funding organisations and large research organisations. Those strategies may overlap with, correspond to or contradict goals of national or European policy.

The **challenge** of designing support policy for international collaboration is to **reconcile these policy drivers with one another and with the motivations of researchers, firms and institutes**. This, to be sure, cannot be free from target conflicts and tensions. Thus, each internationalisation strategy and policy should

have a clear understanding of the relative importance and interplay of motivations and drivers.

2.1.2 The heterogeneity of drivers and policy objectives as for international collaboration in FP 6

Against this general broadening of policy drivers for STI collaboration, how can we characterise the objectives of FP 6 in terms of international collaboration? The officially stated objectives in *principle* cover this breadth of drivers (Council 2002a, p. 4, my highlighting):

1. to help European researchers, businesses and research organisations in the EU and the countries associated with the Framework Programme to **have access to knowledge** and expertise existing elsewhere in the world.

2. to help ensure Europe's strong and coherent participation in the research initiatives conducted at international level in order to **push back the boundaries of knowledge or help to resolve the major global issues**, for example as regards health and environment.

3. to lend support, in the scientific and technological field, to the implementation of the Community's **foreign policy** and **development aid policy**.

The Communication that links ERA with the international dimension, published shortly before FP6 itself, also stressed that the internationalisation strategy should focus on (EU COM 2001) 'making the European Research Area more attractive to the best scientists and making it a world class reference centre'.

How do the objective match with the broad family of drivers in national internationalisation strategies?

Matched against the broad drivers identified in country strategies above, the set of three major EU drivers – access to excellence, problem solving and foreign/development aid policy – shows **two gaps:** (1) competitiveness / innovation / market access on the one hand and (2) defence / security on the other hand. The omission of security and defence from the drivers seems logical given the complex nature of this policy area in general and certainly when it comes to the relation with ERA. To organise international, global S&T activities in this area through a European FP approach would be to make the second step before the first.[2]

The contribution to competitiveness is part of the underlying legal foundation of European RTDI policy in the first place. Still, the fact that it is not explicitly mentioned in the FP 6 as an objective for international collaboration reflects a tension in all international activities funded by governments or political bodies one may think back 25 years to the origins of the FP itself!). However, national governments start to seek participation of foreign firms into their programmes much more pro-actively. This is

[2] The potential tensions between ERA and defence/security – let alone international collaboration and defence / security are manifold – a forthcoming foresight based project (SANDERA) led by A. James, MIoIR, will deal with this relationship.

true although we do not know enough about the net-benefit of international collaboration of (international) firms supported by public funds for the national – and European – innovation system and its relative competitiveness – and the conditions under which collaboration can be turned into lasting benefit for systems.

How do these objectives match with motivations of scientists and offer potential impact on them and the countries involved?

In the absence of a systematic survey into the motivations of EU FP6 participants to collaborate with partners *outside* Europe, we can nevertheless speculate here on the basis of general trends.

There are no indications to doubt that many of the projects done with extra-EU partners in **advanced countries** are driven by the same considerations than regular EU projects. All the major, excellence driven scientific motivations given above apply. This is true for countries like Japan, Australia or certainly the US, where we – based on the scientific capability of the countries – have collaboration on equal footing and access to (complementary) excellence and talent, to advanced skills and infrastructures are key drivers.

For **emerging countries** such as China or Brazil, the picture is much more complicated. In previous years the collaboration with BRIC countries was mainly driven by capacity building and development aspects (object 3). This is changing as research collaboration with BRIC in general is now more and more driven also by excellence (e.g. China, Nano) and/or by tapping into dynamic developments (Brazil, renewable energy) (object 1 and 2). In some area of Nanotechnology, China and other Asian countries are meanwhile main contributors of publications in the world (Guan / Ma 2007; Kahane et al. 2008). At the same time, collaboration with China on the level of researchers and firms and co-operation on the level of administrations is still a means to understand the specific research context there and to influence structures in order to make future collaboration more fruitful. Another example: the most prestigious, non-University basic research MPG society has set up a joint centre with Chinese Academy of Science to tap into the (future) excellence in the country.[3] The idea is to build up structures and capacities in China that allow for better scientific collaboration and institutional co-operation in the future. Equally, we know that application oriented institutes start to systematically work within China and with Chinese co-operators in order to exploit the contract research market there, targeting Chinese and foreign actors (Berger 2008). All this indicates that a strategy for Europe to collaborate with fast changing environments needs to be flexible and responsive to different kinds of motivations. The EU objectives above allow for excellence based collaboration mainly and for problem driven collaboration, less so for strategic collaboration that is market oriented.

Finally, for co-operation with **developing countries** the motivations of scientists form advanced countries again partly shifts, with access to the object that is studied and attempts to build up matching capacity becoming more important. Interestingly, while some countries, such as France, have a strong tradition of building scientific capacity

3 See http://english.cas.cn/english/news/detailnewsb.asp?InfoNo=25678

especially in former colonies (Clément 2008). There appears to be a new interest of funding organisations (mainly foundations) to finance co-operations to build up capacity (Krull 2008, Lynn 2008), at the same time Member States increasingly link development approach for S&T co-operation with developing countries towards capacity building and common problem solving (Boekholt 2008, G8 2008). Within FP6 the **INCO approach** (see below) allowed for **problem driven** and **capacity building activities** in a dedicated programme for non-developed countries. Within FP7, INCO has been incorporated into the thematic areas, which may (but: evidence needed) downgrade the capacity and problem driven approach again and stress the excellence and science driven approach also for developing countries.

To sum up, during the life of FP6 we may expect a slight shift in motivations in international collaboration when compared to earlier FPs, with emerging countries coming more into the focus of excellence driven co-operation and a new awareness of the opportunities lying in collaborating with developing countries, both for the build up of matching capacities and the contribution to solving problems.

3 INSTRUMENTS

The major instruments used in FP6 to foster international collaboration were threefold:

1. The opening of "Focusing and Integrating Community Research" to third country organisations. This in fact is the possibility for third country partners to participate in a consortium of European partners in the regular programme. While all partners from all over the world are eligible for participations, the 285 million EURO specifically earmarked were etargeted at so-called INCO-partner countries (developing and emerging countries). Funding of participants form other, developed countries was possible, if provisions in the specific working programmes had been made and the participation was needed in order to carry out the RTD work.

2. Specific measures in support of international co-operation (INCO). This is the programme specifically dedicated to international collaboration focused on a set of regions and thematic areas (see below). The funds earmarked for international co-operation here has been 315 million EURO.

3. International activities under the heading of Human Resources in the specific programme for research, technological development and demonstration "Structuring the European Research Area".

The discussion of participation in the Framework Programme below will differentiate the three instruments. Further, more indirectly linked to the FP, are international activities through the basic science driven **COST** and the application oriented **EUREKA**. Further, the EU has **STI agreements** with 16 third countries. These agreements are not part of the FP and do not offer earmarked funds for research

collaboration, but can be catalytic for FP projects, mainly NoE (COST)[4] and JTIs (EUREKA) and help to raise awareness of collaborative activities more generally.

In principle, partners form industrialised countries would not receive funding but participate in projects without funding. However, if the expertise or any other characteristic of a partner was indispensible for the success of the project, the EC still financed, with the same co-funding rules apply for EU participants. In FP 6 there was only one attempt for a joint call between the EU and one country (the US), in FP7 this is now explored and broadened.

The specific design of INCO

In order to link the problem driven approach and the foreign and development policy to international research collaboration, the INCO programme line in FP6 was designed around thematic priority areas for the four defined target regions/countries (EU COM 2007b):

- Developing countries: health and public health, food security, and the rational exploitation of resources.
- Mediterranean third countries: environment, health and water issues, protection of the cultural heritage, aspects of sustainable rural development
- Western Balkans: support of stability of the region, issues relating to the making good of the consequences of war on the environment, health and agricultural and industrial facilities.
- Russia and other NIS countries: stabilisation of R&D potential, issues relating to changes in the industrial production system, environment and health protection and related safety aspects.

The design of the approach itself is important. One must acknowledge that the Commission has put in place some regional and thematic focus and at the same time designed the programme as a means to make third country participants fit for activities in the main part of FP 6. It is part of an internationalisation strategy to priorities and to focus, to take into consideration the various country or regional context and define areas in which S&T can have most leverage effect. Some Member States are going in similar directions.[5] In parenthesis: while FP 7 has incorporated INCO within the thematic areas, it has kept up regional dialogues and priority supported by ERA-Nets and INCO-Nets, thus strengthening the ERA and Ljubljana dimension to international co-operation (see below, section 6).

Little written evidence is available as to how research policy on the one hand and development/aid and foreign policy on the other hand are actually coordinated. On various occasions references are made between INCO documents and regional strategies of the Commission as such, as the regional priorities are said to be 'the result of an agreement between the EU and intergovernmental regional organisations', and the horizontal priorities, Health and Environment, and the specific priority for developing countries, Food Security, reflect the official Millenium

4 For a short discussion of COST and international collaboration see EU Expert Group 2008.

5 For example Austria has discussed a shell model for countries to target, the German strategy also has different country foci (Edler et al. 2008, Edler 2007), most countries now try to follow a differentiated approach (CREST 2008b).

Development Goals.[6] The recent evaluation of INCO[7] claims that the thematic areas for the various regions do indeed reflect the regional policy priorities of the EU as outlined in the various regional strategy papers and they do fill gaps in the development policy of the EU. The evaluation at the same time states that the research activities in FP funded through INCO did not have a high priority within the regional aid and development policy of the EU and that the coordination across the whole of the Commission could be improved when it comes to INCO activities.

In addition, the participation of INCO countries is not limited to those INCO priorities. The targeted INCO approach taken does not exclude the participation of researchers from those areas in other parts of FP6. The participation statistics will show that the participation is broader, i.e. researcher from areas outside the priority areas have been able to participate outside the ring-fenced areas in INCO.

New governance schemes for international collaboration

Finally, the means to internationalise research in Europe go beyond funding opportunities. FP6 has offered a range of new governance instruments that also have their impact as for the international dimension. Most notably, the **European Technology Platforms** have started new ways of dialogue between actors organised at European level and extra-European partners, and some **ERA-Net** have had and have considerable impact on shaping the relation to certain target regions, and shaped the way for the INCO-Net in FP7 (see below, section 6).

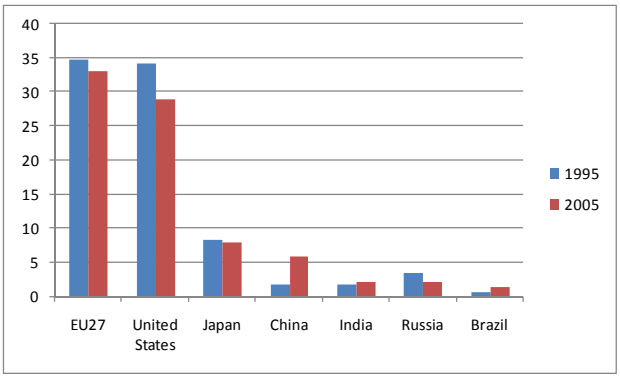
4 TRENDS IN THE INTERNATIONALISATION OF S&T, THE RELATIVE ROLE OF EUROPE AND IMPACT ILLUSTRATIONS

To situate the scope and scale of international collaboration within the European Framework Programme one has to look at the relative position of Europe in the global STI arena and at the overall patterns and trends in international collaboration. This sets the context for Europe as an international partner and puts FP 6 activities in context.

Europe still produces **one third of all international scientific publications**. While its relative weight as originator of scientific publication has slightly decreased, it has done less so than the weight of the US. China saw far most significant growth in relative share with 6% in 2005.' which is still slightly less than Japan but roughly the total of the other three BRIC countries together (see Figure 2). Thus, **the relative role of Europe is very strong and the potential for EU partners with BRIC partners is growing** (except for Russia).

6 Self assessment of Dir. D.
7 Ramboll (2006): Evaluation of INCO Programme. Final report. October 2006

Figure 2: Share of countries in global scientific publications, 1995 and 2005



Source: Pilat 2008 (based on NSF and OECD data)

Secondly, the ***overall* investments in R&D** in Europe are now not only far behind the US (according to the OECD Main STI Indicators 2008/1, latest data 2006 saw 100 billion USD less GERD in Europe than US), but since 2002 OECD figures show that a number of Asian economies[8] now also outspend EU 27 EU COM 2007a). As the relative **share of Europe in terms of GERD is declining**, **outward looking** has (and will) become **increasingly important** (Table 1).

Table 1: Share of GERD for OECD countries and a selection of non OECD countries

	1995	**2005**
EU 25	28,9%	25%
US	38,4%	34,4%
Japan	15,9%	13%
Other OECD	8,6%	9,3%
Non OECD (incl. China)*	8,1%	18,3%
SUM	100%	100%
China	*3,6%*	*12,7%*

Source: EU COM 2007a, p. 11, data source: OECD

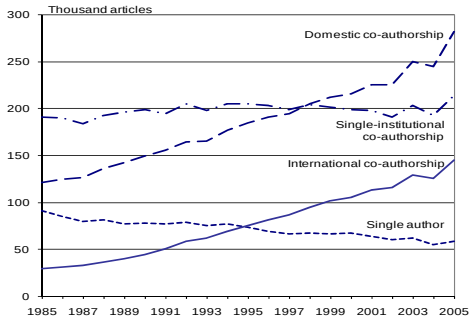
* China, Russian Federation, Chinese Taipei, Israel, South Africa, Singapore, Argentina, Romania

Thirdly, while science, in a sense, has always been international and at the forefront of international co-operation, we have seen a **dramatic rise in international collaboration** in the **last 20 years** (see Figure 3). This is true not only in absolute terms, but also as regards the relative importance of international collaboration which has grown vs. single authored publications and national co-authorship. The trend is strong for the OECD world and the emerging economies like the BRIC countries (Wagner and Leydersdorff 2007, Glänzel, 2001). Especially China had a dramatic rise of international co-publications, with an increase of more than 100% between the period 1995-2000 and 2001 to 2005 (Adams et al. 2007). For the EU, though, we have to keep in mind that the share of international co-publications in all publications still differs considerably between Member States. By and large the **smaller countries** are co-operating **more internationally** than the larger countries, and the **new member states more** than the old ones (EU COM 2007a, p. 25). This is clearly a reflection of the available pool for adequate partners in the domestic home science systems (Georghiou 1998), but also shows how quickly the Central and Eastern

8 China (not including Hong Kong), Chinese Taipei, Japan, Singapore and South Korea.

science systems have been integrated into global and especially European knowledge production.

Figure 3 : The rise of international co-authorship, example of natural science



Source : OECD STI Scoreboard 2007, based on NISTEP

What may all this mean for Europe and **extra-European collaboration**? To start with, the share of international, extra-European collaboration is strongly increasing (see Table 2).

Table 2: Share of international co-publications in all publications, EU 15 (discounting intra-European collaborations)

Country	1991	1998	2005
EU-15	13.5%	21.5%	27.7%
US	12.1%	20.7%	26.8%
Japan	9.8%	16.6%	22.4%
China	24.5%	26.2%	21.9%
South Korea	28.3%	24.4%	25.7%
Chinese Taipei	16.5%	16.3%	19.1%
Brazil	29.0%	35.0%	30.7%
Turkey	20.7%	18.1%	16.0%

Source: EU COM 2007a, p. 25

The overall number of intra-European collaborations has increased even stronger than the extra-European collaboration for all countries except for the big three (UK, Germany, France; Mattson et al. 2008). While size makes a difference for the intra-European collaboration, with smaller countries collaborating more intensively inside Europe, **for collaboration** with partners **from outside Europe size** has **not** been found to make a **difference** (ibid 565). This may point to a specific role of the Framework Programme to enable partners from small countries to co-operate with extra-European partners. Interestingly, the size of collaboration networks is bigger for extra-European collaborations than for intra-European collaborations, which indicates that extra-European collaborations most often entail various European partners (ibid p. 570), and thus is in line with the basic approach of the FPs.

While the increase is strong in all fields, there are still **differences as for the relative meaning of international collaboration across fields** (Adams et al. 2007, Edler 2007). The natural sciences have the highest share of international collaboration (for Germany, for example, the share of international collaboration of all publication was roughly 50% in 2004, Ebersberger 2008a), while social sciences are far less inclined

to co-operate internationally and in the arts/humanities growth and share are very moderate still (for Germany less than 5% international collaboration in 2004). It is evident that the scientific area and thus the nature of knowledge creation plays a significant role here, with different scientific fields having different needs to share infrastructure, pool data and methodological skills or bring together highly specialised complementary knowledge (Adams et al. 2007, Wagner 2006, Kuhlmann et al 2007, EU Expert Group 2008).[9] Table 3 illustrates the differences even *within* the Natural and Engineering Sciences for EU 25 countries, US and Japan. The major **lesson for the FP** is that we need **to allow for flexible internationalisation** and should not aspire for equally high share of international collaborations across fields.

Table 3: Share of international co-publications out of all publications, for EU25, discounting intra-European publications, engineering and natural sciences

Discipline	EU-25	US	Japan
Fundamental Biology	24.1	24.5	22.0
Medical Research	16.1	18.8	14.8
Applied Biology-Ecology	22.9	22.6	18.6
Chemistry	21.5	23.9	15.7
Physics	33.3	36.6	24.1
Astro-sciences and Earth Sciences	33.6	34.3	39.2
Engineering	20.8	23.9	17.9
Mathematics	27.0	34.4	25.1
Total	**22.9**	**24.4**	**19.3**

Source: EU COM 2007a, p. 26

Finally, we have bibliometric data to map the **country co-operation patterns**. It shows the **overriding importance of the US for Europe and vice versa**. Interestingly, the EU has diversified its partnerships more broadly than the US. The US is more focused on EU partners than the EU on US partners. It also shows that for some countries, such as South Africa, Brazil, Russia and India, Europe is more important as partner than the US, while for Japan, China, South Korea the share of US partners is higher (Figure 4). One first conclusion out of this may be that Europe has succeeded in tapping into knowledge more broadly than the US, building on historical legacies and capitalising on pro-active efforts to internationalise (see below).

Figure 4: Share of international partners for the EU and selected countries* (2003), based on co-publications

With \ Of	EU-25	US	Japan	China	India	South Korea	Russia	Israel	South Africa	Brazil
EU-25	-	52.4	33.8	31.9	43.9	18.7	66.9	45.4	57.1	49.7
US	44.7	-	40.2	35.3	34.3	53.7	24.4	51.6	31.5	37.5
Japan	7.1	9.9	-	16.8	11.4	22.3	8.2	4.4	2.9	3.8
China	4.2	5.4	10.6	-	5.1	8.2	2.7	2.2	1.8	2.2
India	2.1	2.0	2.7	1.9	-	3.1	1.2	1.0	2.0	1.7
South Korea	1.2	3.9	6.7	3.9	4.0	-	2.8	1.1	0.7	1.0
Russia	8.4	3.6	4.9	2.6	3.0	5.6	-	4.9	1.9	3.7
Israel	2.5	3.3	1.2	0.9	1.2	0.9	2.1	-	2.2	1.3
South Africa	1.2	0.8	0.3	0.3	0.9	0.2	0.3	0.8	-	0.7
Brazil	2.9	2.5	1.1	1.0	2.0	0.9	1.7	1.3	1.8	-

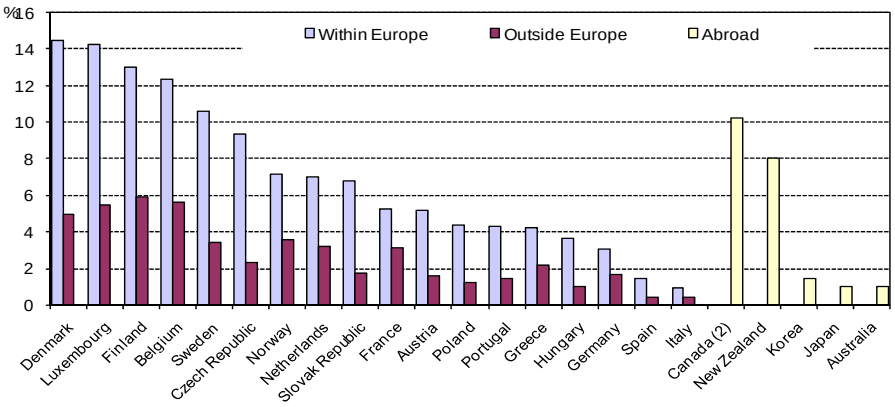
9 Although, as Wagner rightly states, we still do not know enough to link the properties of a science field to international collaboration patterns, the evidence is not yet consistent and a range of non-area specific variables interfere (Wagner 2006).

Source: EU COM 2007a, p. 26,
* read e.g. for the EU: column – 44,7 % of all international partners are from the US; row – 52,4 % of all US partners are from EU-25

The table shows that for each and every partner the EU has more relative weight than this partner has for the EU. This is a natural consequence of the size of the science systems, but we have to keep this imbalance in mind when discussing the motivation of third country partners to co-operate with European partners and when discussing STI agreements.

To complete the picture, we need to include application and market driven collaboration. First, as Figure 5 shows, companies have a high level of international co-operations on *innovations* (which is broader than R&D co-operation). Similar to scientific co-operations, companies **co-operate much more with partners from Europe** than with partners from outside. There are also **striking differences in the inclination of companies to co-operate internationally** between the various countries, with countries like Denmark, Belgium and Finland having a rather high share, while Italian, Spanish and German companies are much less inclined to co-operate internationally for innovations. We have to keep these differences in mind when discussing the relative importance of FP 6 for international co-operation outside Europe.

Figure 5: Firms with foreign co-operation on innovation, 2002-2004 (as a percentage of all firms), manufacturing only



Source: Pilat 2008 (based on OECD STI Scoreboard 2007, on Eurostat (CIS-4) and national sources)

Need for policy: Impact of international collaboration in science and technology

What are the **effects** of international collaborations that justify policy action? A set of illustrations may suffice here.

On an individual level, the first, most often used impact indicator reflects scientific excellence that is measured through citation. The message here is straightforward: it pays off to collaborate internationally; international co-authored papers are more highly cited than single authored papers or publications based on national co-operation (for many Glänzel et al. 2006, Roberts 2006).

But impacts are broader. The vast majority of public researchers surveyed in a recent study (Germans and foreigners in Germany, Edler 2007) experience an overall net

utility gain from their international activities. Internationalisation helps them to make a name for themselves, step up their performance (publications, co-operations) and thus their careers. International activities accelerate knowledge generation, avoid duplicated work, increase competencies, increase researchers' (measurable) output, and reduce costs and risks through pooling (see also Technopolis 2005 for the UK).

Equally, a second survey with research institutes has found that if public research institutions are internationalised in terms of personnel (mobility), trans-border co-operation or even physical presence abroad, they are not only more competitive and attractive (institutional benefit), but can be the pipeline for global knowledge for local companies, monitoring and re-transferring knowledge from abroad. This contributes significantly to increasing the overall effects of internationalisation for a system, an effect seldom discussed and never measured (Edler 2007).

On a country level, the general benefit of pooling knowledge and efforts to tackle common problems, contribute to sectoral policy and – more generally – make research more effective and efficient and thus the system more competitive and attractive, are evident. Obviously the types of benefit severely differ between countries of different development level (as they differ for scientific areas, industrial sector etc.).

In consequence, the need for internationalisation policy and the rational for funding are derived from this – inconclusive[10] – list of **benefits** which all have a public good character, and from the **related transaction costs and hindrances researchers and companies experience.** And **the more global the potential networks for the generation of knowledge, the more global our common problems, the more global the policy must be designed.**

However, there are no comprehensive, systematic studies on the overall effects of international collaboration, especially when it comes to public science. This is true both on the level of institutions and the level of societal and economic impacts. **D**ue to the lack of indicators to measure all those impacts on individual, institutional and country level (Boekholt et al,. 2008), **the benefit of international activities appears undervalued** – and an optimum level is not to define.

5 PARTICIPATION AND PROFILES OF INTERNATIONAL COLLABORATION

In this chapter we will display and analyse the participation of third countries within FP 6. The data source here has been provided by the Commission. For the purpose of this expertise the data is sufficient, it gives a decent picture of the participation patterns. For further analysis however, e.g. in a full real evaluation of international participation, more comprehensive data will have to be used, such as collaboration patterns between countries, the network of actors including third country actors (we only had this for EU 27) and the breakdown of industry actors also in SME vs. large companies for third countries. Due to changes in the database between FP5 and FP 6 we also lack the possibility of easily comparing systematically participation patterns between FP 5 and FP 6.

10 I did not elaborate on the benefits for companies, see Edler / Polt 2008 for a recent summary.

The relative share of third countries

In the following, the participation of third countries in FP 6 is looked at. To start with, table 4 shows the overall participation of third country partners and the financial contribution the third countries as a group have received.

Table 4: The participation and EC contribution for country groups

	EU27		Candidates		Associates		Thirds		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%
Participants in Proposals	323522	87.71	4693	1.27	18986	5.15	21633	5.87	368834	100
Participants in Contracts	65314	87.79	684	0.92	4187	5.63	4215	5.67	74400	100
EC Contribution (€'000)	1,525,5285	91.54	79,985	0.48	954,088	5.73	375,908	2.26	16,665,265	100

Source : DG Research, own compilation

We see that the share of third countries is **5,6 % of all participants**[11]. This includes large European partners such as USA, Japan and increasingly China. Compared to the very high importance of extra-European co-operations (measured in co-publications, see Figure 4 above) this is modest. The new German strategy targets 20% foreign participation (not contribution, though, Matthes 2008), but coming from a much lower level. However, we lack a comparison here, and at least to my knowledge no target figure was given in the beginning of FP6.

Altogether, the **third countries received roughly 375 million EUROS and thus approximately 2.3% of the FP budget**. Out of the 375 million EURO 250 million EURO were spent in the regular FP actions, 125 million EURO through the INCO programme. The original budget earmarked for the INCO programme alone was 325 million EURO, this was regarded as a target, not a ceiling and the overall money that was spent in INCO projects is roughly 345 million distributed across 294 projects (and with very mall contribution to other non-INCO Third country). Thus, 220 million EURO within INCO were spent on participants from Member States, Associated and Candidate Countries in their projects with third country Inco partners.

The average contribution per third country partner is much smaller than for EU or associated partners. This average is somewhat distorted as in principle developed country partners do not receive EC contribution. The advanced third countries received on average between 29 KEURO (US) and 35 KEURO (JP) per project, the INCO slightly more than 100 KEURO and the EU 27 countries 234 KEURO.

What does that mean for the mobilisation of the budget for international collaboration? The overall budget for international collaboration in INCO and the other actions of FP6 was 600 million EURO (see above). This figure was not reached. ., and there are indications that the mobilisation of third country partners in

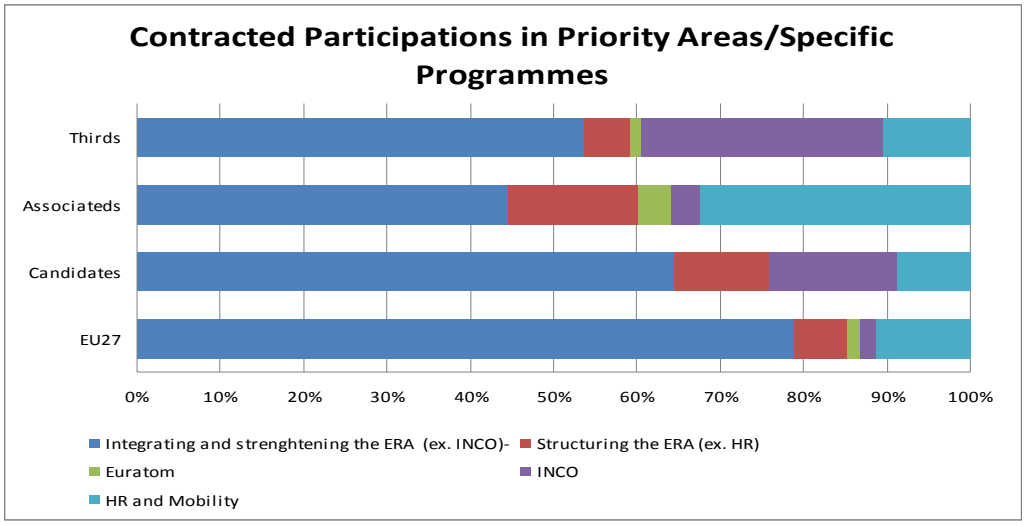
11 The share is the same if we exclude the Marie Curie scheme.

FP 6 was challenging. The official Monitoring Report 2005 refers to the additional calls launched by DG Research to mobilise third country partners in existing projects of FP, and still, the 285 million EURO earmarked for international participation could not fully be spent. Further, the INCO evaluation states that out of the 315 million EURO reserved for INCO and INCO countries, only 309 million were spent.[12]

Participation of selected third countries and country groups

Figure 6 indicates how the various country groups made use of the different programmes and action lines within FP 6. This relative distribution matches expectations, third countries and candidate countries (geographical proximity to priority regions of INCO) show a large focus on the INCO programme.

Figure 6: Making use of various programmes and activity lines in FP 6

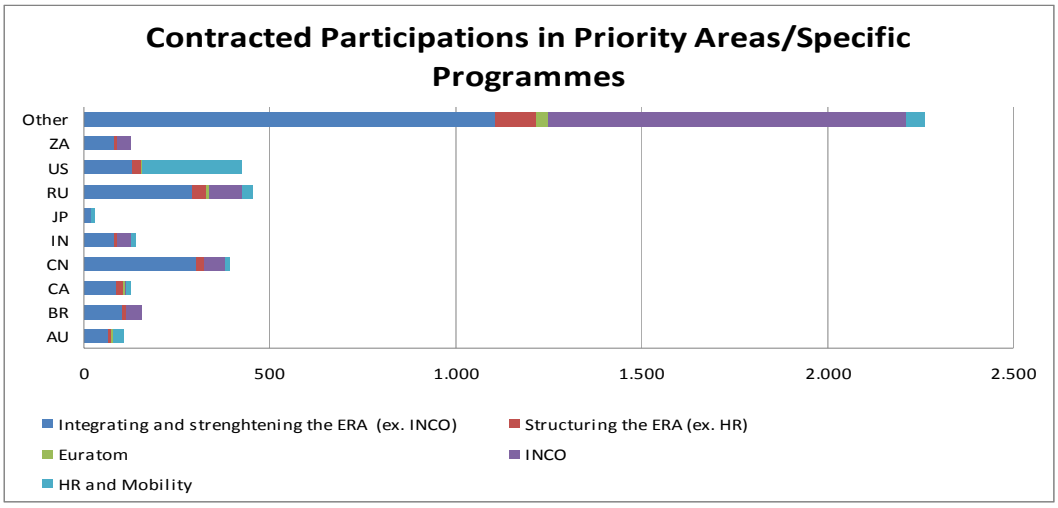


Source : DG Research, own compilation

We can further break down the participation for selected countries within third countries (Figure 7).[13] Our data basis for figure 7 is restricted here to the countries shown in the graph, but for the purposes of this assessment it is sufficient as these are clearly the most important countries, together covering far more than 50% of the participation.

12 For reference see FN 7 above.
13 For a further breakdown please refer to the recent evaluation of INCO, see FN 6 above.

Figure 7 Breakdown of participation, selected third countries



Source : DG Research, own compilation

Table 5: Number of participants of and EC contribution for selected third countries*

Third Countries		AU		BR		CA		CN		IN	
4.215	*375.908*	107	*3.775*	155	*14.397*	127	*2.621*	395	*35.192*	136	*11.878*
JP		RU		US		ZA		Others			
29	*1.005*	454	*49.844*	426	*12.527*	125	*14.436*	2.261	*230.233*		

left box number of participants, *right box EC contribution, .000 EURO*
Source : DG Research, own compilation

Table 5 and Figure 7 show that the FP collaboration patterns do in **no way reflect the overall collaboration of European scientists** (see Figure 4 above) and **their desire to co-operate especially with the US to tap into forefront knowledge there.** Given the relative strength and importance of US or Japan the participation of those countries still seems low, if we discount for the Marie Curie participations we have 159 participants form the US and 22 from Japan. The German study (Edler 2007) found that the most important gap in funding availabilities for German scientists was schemes to collaborate with advanced extra-European countries, mainly the US. This means that scientists fully appreciate the FP as major means for collaboration within the EU, but do not see it as a major means for trans-Atlantic co-operation. Here, **joint funding models** that have been tested in FP6 and now are tried more broadly in FP7 should certainly help to raise awareness on both sides of the Atlantic and mobilise US actors, which has been found to be missing (Kettunen et al. 2003).

In terms of **emerging countries** such as India and China, the development of the overall participation is **encouraging** and has severely increased compared to FP5[14]. **However, given the growth and future role of those countries, the number of**

14 This findings stems from the assessments of the STI agreements with China (Watson et al 2004) and India (Pandey 2006).

partnerships is still sub-critical. The important role the EU has for Russia as scientific partner (again see Figure 4 above) can be seen also in the participation patterns of FP6.

As regards the relative importance of INCO itself, we see that 40% of all third countries participations are in this programme. It seems that for the bigger and more advanced countries this share is smaller, they apparently prefer to participate across the board rather than being restricted to the priority lines given in the INCO calls. If we further differentiate the participation only within the INCO programme, we see the global spread and especially the mobilisation of Africa partners Table 6.

Table 6: The participation of regions within in INCO

INCO Country group	Number of participants
AFRICA	247
ASIA	172
CARIBBEAN	5
RUSSIA+NIS	165
LATIN AMERICA	191
MEDITERRAEAN COUNTRIES	356
PACIFIC	0
WESTERN BALKAN COUNTRIES	167

Source : Ramboll 2006 : Evaluation of INCO Programme

Table 7 and 8 give an idea about the content areas financed with INCO activities.

Table 7: the INCO target regions and target areas – project uptake

DEVELOPING COUNTRIES (DEV)	***85, of which***
Food Security	25
Health and Public Health	34
Natural Resources	26
MEDITERRANEAN PARTNER COUNTRIES (MPC)	***53, of which***
Cultural Heritage	13
Environment	34
Health	6
RUSSIA AND THE NEW INDEPENDENT STATES (NIS)	***10, of which***
Environment	10
WESTERN BALKAN COUNTRIES (WBC)	***16, of which***
Environment	13
Health	3
Grand Total	**164**

Source EU COM 2007c, own compilation
* SSA not included in this data

Table 8: The budget allocation per region and thematic area within all INCO projects

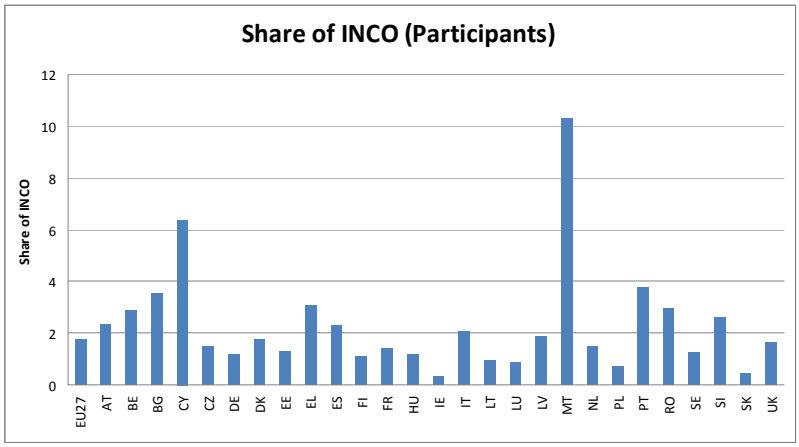
Thematic area	DEV	MPC	WBC	Russia +NIS
Water	15%	41%	14%	7%
Energy	1%	21%	23%	1%
Other Environment	23%	1%	19%	60%
ST Environment	*40%*	*63%*	*56%*	*69%*
Food security	11%	5%	0%	0%
Post-conflict trauma	0%	1%	12%	0%
Health and disease	49%	**6%**	4%	**3%**
ST Health	*49%*	*7%*	*16%*	*3%*
Protection and conservation of cultural heritage	0%	25%	0%	0%
Communication networks	0%	0%	2%	**1%**
Other research areas	0%	0%	7%	0%
Competitiveness and innovation in the industry	0%	0%	0%	24%
Capacity building in research	0%	0%	19%	3%
TOTAL (M EUR)	157.9	67.7	27.2	17.1

The grey areas indicate the priorities identified in the INCO work programmes for each region
Source : Ramboll 2006 : Evaluation of INCO Programme

The data above indicates the broad thematic scope of INCO. The uptake reflects by and large the dedicated areas for the various regions which, on the basis of the INCO evaluation as stated above, are linked to the priorities in the regional strategies of the EU (see above, chapter 3)

Figure 8 indicate how relatively important the INCO participation was *for the EU countries*. This is one indicator as to the inclination to cooperate with partners from non advanced third countries (although many of those partners also participated in other action lines). We see quite some variety, but all countries above average are either small countries or New Member States (regional proximity to Eastern Europe / Western Balkan regions).

Figure 8
The relative share of participations in INCO out of all participations for EU countries



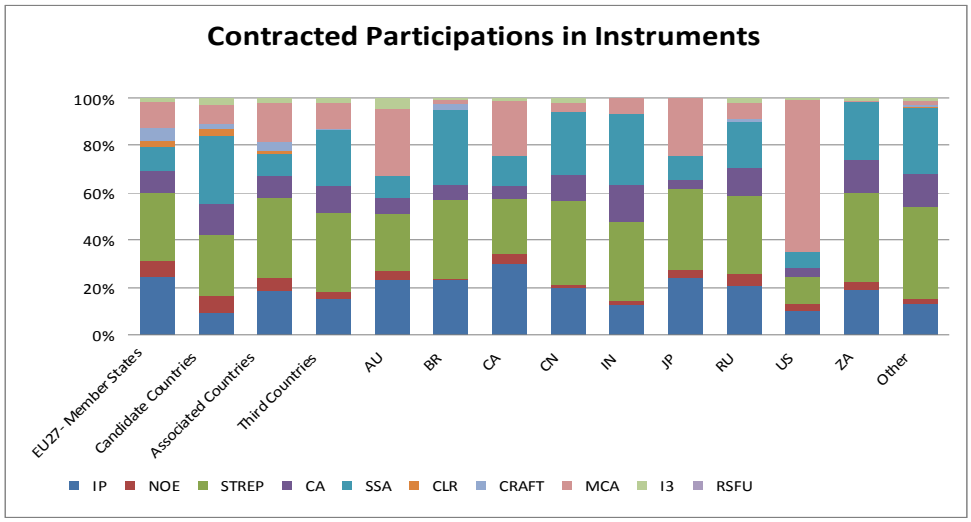
Source : DG Research, own compilation

In terms of outcome of the funded research work within INCO, the INCO evaluation claims that INCO had a positive impact on the third country participant's networking and capacity building and provided access to forefront knowledge in the dedicated areas.[15] However, we miss data and analysis as to the relative meaning of INCO for the cooperation activities of INCO countries more broadly. Beyond the level of individual participant's perceptions we thus do not know what difference INCO really makes for the countries at large.

The international participation in different instruments

FP 6 offered a range of new instruments, especially the Integrated Projects and the Networks of Excellence. Looking at how third countries used the instruments, four observations stick out. First, we see that for **third countries participation in NoE was less attractive** (not so for IP), although the idea of integrating within a certain field or across fields in Europe would benefit from excellent partners more globally who would inspire and upgrade this integration and co-operation process. Even if the future of NoE is especially uncertain, one dimension to consider would be the role that larger, integrating structures could play in organising international scientific discourse on the basis of and facilitated by a European integrative platform. Second, the **SSA scheme has been popular** with third countries, especially Brazil, China, India, the support action has worked as a leverage. Third, there are **big differences as for the Marie Curie action**, with the US being by far the most important beneficiary while the 'other' INCO countries are much les involved (see below, mobility). Fourth, and not surprisingly, the **CRAFT action is not important**, participation from third countries in SME oriented schemes is very low.

Figure 9: The relative uptake of instruments



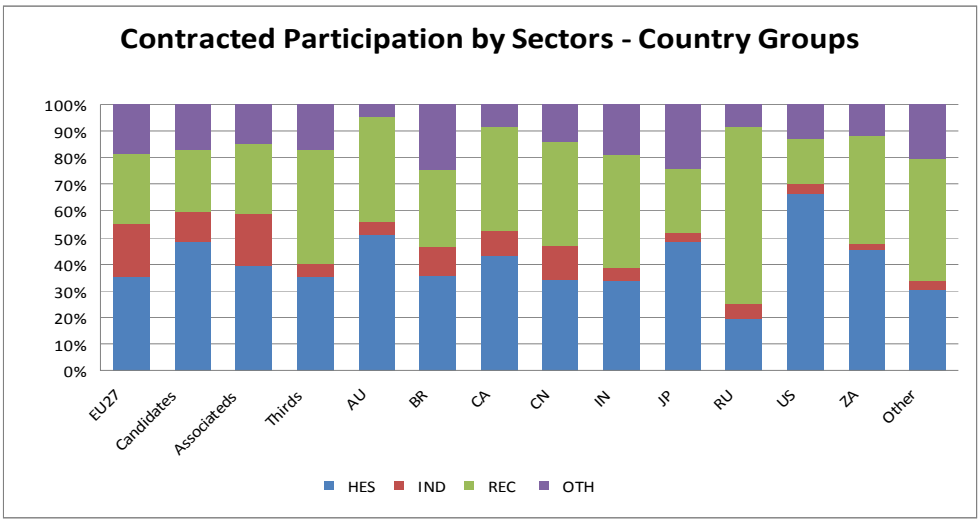
Source : DG Research, own compilation

The actor types involved: less industry from third countries

15 For reference see FN 7 above.

Not only are SME schemes less important for third countries, FP6 has – relatively speaking –**attracted less industry participation from third countries** than for the other country groupings (Figure 10). Altogether, 221 companies from third countries have participated in FP6 (these are non-SME as SME appear to be included in the 'other' category). Interestingly, the highest relative share of industry participation (52 firms) is from China followed by Canada. The industry participation of the US is negligible. The differences between University and Research Organisation participation is due to different structures of the research systems.

Figure 10: Type of Actors participating



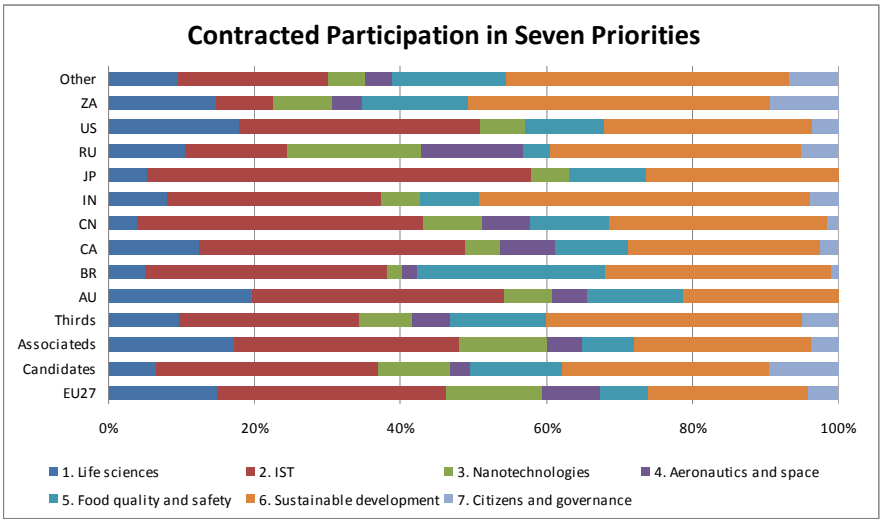
Source : DG Research, own compilation

It would be interesting to analyse how and in which constellation European companies have been involved in projects with third country partners. The data so far does not allow for this analysis. What we do know is that on average only 0,7% of industry participants of the EU countries participate in INCO (36 EU industry (non SME) participants in INCO projects), and thus **extremely low.**

The thematic profile of international collaboration

Finally, our data allows to look at the thematic priorities across selected countries and country groupings within the specific programme 'Integrating and Strengthening the ERA' (Figure 11). Most strikingly, the **third countries have a much higher relative share in the area of sustainable development** (next to the INCO programme which puts heavy emphasis on this dimension as well, see above) than other participants. They link apparently the excellence driven research in this programme to the problem driven approach in their countries and can add expertise to European consortia in this area particularly. For the US as biggest partner we do not see a very different pattern, except for some lower representation in Nano than one would expect. For China, the growing capacity and strengths in Nano has not materialised in FP6, while India shows its strength in ICT also in the participation pattern.

Figure 11: The relative importance of priority areas for third countries



Source : DG Research, own compilation

Extra-European Mobility

The third pillar of the international dimension is international mobility as financed under the Marie Curie action. As for international, extra-European mobility, three activities stick out: (i) international fellows and partners in Host Driven Action, (ii) the International Individual Fellowships[16] and (iii) the International Re-Integration Grant.

(i) For the **host driven Actions**, institutes in third countries could participate, but not as coordinators. Fellows from third countries could be hosted in an organisation in a EU Member State, Candidate Country or Associate Country, but not in a third country organisation. There was a ceiling of third country participation either as fellows or institutes of 30% (EU COM 2008b).[17]

The **host driven** actions in FP 6 had altogether 2346 partners, and only 67 of those partners were from 14 third countries. This amounts to 2.9% and is below the overall participation rate in the FP6. **More than half of the partners (35) are from the US,** followed by Russia (13), other countries with more than 1 participant are Japan (5), Canada (3) and Australia (2) (all data from EU COM 2008b, p. 59-60).

In terms of fellows recruited by the hosts from third countries, their share is 15.2% (1028), **this scheme apparently was able to attract talent from outside Europe on an individual basis**. Here, Russia is dominant with 144 fellows (14% of third countries), followed by India (128 fellows, 12,4%) and the US (123 fellows, 12 %).

(ii) As for **individual fellows**, the involvement is of course much broader. There are two principle schemes, an **International Outgoing Fellowship (IOF)** and an

16 I will not comment on the variety of activities within the overall mobility strategy of the EU which entails web-portals (such as ERA-Link for the EU network of European researchers), activities to streamline and simplify entry from Third Countries and the like, see EU COM 2005.

17 The source for Host Driven Action is an interim preliminary report of DG Research the data of which might still change.

Incoming International Fellowship (IIF). The former is a bottom up approach for EU and Associated Country researcher to conduct a research project in a 'world class' research organisation in a third country. It consists of two phases, first phase (one to two years) in the third country, second phase (half the time of first phase) as a mandatory phase back in the EU/AC to enforce knowledge transfer and inter-institutional linkages.

The logic of this scheme corresponds in fact to the needs of scientists as it has become apparent in a recent survey (Ebersberger et al. 2008b). The major motivation for mobility is to further one's scientific career and get access to leading institutions and clusters. While short time mobility (up to a couple of months) also has its merits, a longer stay has proofed to be significantly more effective in terms of building up careers and leading to high level publications (ibid. p. 126). However, the major problem for mobile researchers is to find ways back into the networks and institutions in Europe. To link outgoing mobility with a mandatory return phase thus enables scientists to capture the experience, but within a secure return perspective.

The incoming individual fellowship (IIF) is the reverse model, whereby a fellow from a third country has an incoming phase of one to two years funded. A return phase can be funded for researchers form less developed countries, not from industrialised countries, though.

Both schemes together thus follows the logic of **avoiding brain drain from Europe**, but equally **securing brain circulation** with developing countries. However, they also offer opportunities for recruiting researchers from *advanced* countries with no in-built financial incentive to return (and it is certainly an issue for a future evaluation to check for the share of researchers that stayed in Europe). Table 9 below summarises some major characteristics regarding the participation within the two fellowship schemes (EU COM 2008c).

Table 9: Some structural data on Marie Curie

	EIF	IIF	OIF	Total
Budget FP 6 (ME)	250	71	66	387
Funded fellows	1600	302	380	2285
Success Rate	17,6%	21,6%	17,6%	
Avg. cost	154204	226041	163192	
Nationalities Fellows	86	83	30	
Host Nationalities Europe	32	27	28	
Host Nationalities third countries	NA	15	42	

Source: EU COM 2008c

As for the **Outgoing Fellowships** (OIF), the countries with the highest share of outgoing Fellows were France (21.5%), Germany (15.6%) and Spain (12.3%) and Italy (11.9%). The country vastly underrepresented is UK with 7.9% of all Fellows (EUI COM 2008, p. 18). The distribution of the 302 host organisations for the Fellows were highly concentrated: by far most popular was the US (226; 63%), followed by Canada (26; 11.3%) and Australia (33; 10.6%), New Zealand (4), Japan (3) and nine countries with one Fellow. This lopsided result is not much different from studies on mobility of researchers more generally, outside specific schemes (Ebersberger 2008a, 2008b). What appears to be alarming, though, is **the lack of attraction** towards those countries that have become important collaboration partners and will

become even more in the future, such as **China, Brazil or India**. This is partly a lack of interest in or cultural affinity to those countries and their organisation, which has also been acknowledged in the STI agreement assessments. Partly it is also due to lack of quality of the proposals (which might be connected to the quality of the host organisation), as the success rates for Brazil (0 out of 16) or China (1 out of 10) or UA (1 out of 23) are very low.

As for the Incoming International Fellowships (IIF), 2156 Fellows from 83 different countries applied, the 380 funded Fellows came from 40 countries. The countries from which most fellows came to Europe were Russia (59), China (46), US (40), India (37), Australia (34), Japan (22), Argentina (17), Ukraine (15), Brazil (12) and Mexico (11). The basis here is thus much broader, and the patterns are clear: **researchers move to the US**, while **Eastern European, Asian (China) and South American researchers move to Europe**, a pattern again entirely in line with the results of the German survey mentioned previously (Ebersberger et al. 2008a).[18] Since the fellowship is highly competitive and based on excellence both of the fellow and his host organisation, Europe can only gain from the influx of highly skilled researchers. What needs to be looked at in more detail is **how the integration of the fellows in the various schemes is taken care of**, a simple presence is not productive for the absorbing system. Further, an evaluation would have to look at how sustainable linkages between institutions are once the Fellow has returned.

(iii) Finally, the **International Reintegration Grant** in FP 6 has been set up to ease brain drain especially for small and New Member States, allowing for set incentives for ex-patriates to come back and upgrade the science system and its international linkages. This scheme has apparently worked very well for some countries (CY, GR, TR) and now starts to be effective more broadly.[19]

While the Marie Curie Mobility scheme is still *mainly* about intra-European mobility, networking and internal labour market for researchers, the extra-European dimension has increased in importance. The schemes set up in FP 6 went in the right direction as they acknowledged the value that lies in extra-European mobility in both direction. They also acknowledge the need for Europe to attract foreign talent pro-actively and to enable Europeans to gain the experience and networks they need. Given that mobility is a stepping-stone for future collaboration and exchanges, Europe should maybe even invest more in its extra-European schemes, and make sure – even through evaluation criteria – that full integration is stabilised and lasting relationships built up. Full integration would then also mean that the Marie Curie scheme should be more generous in financing events in host driven actions for **non-fellows** to participate and thus to build up a larger community of practice that is internationalised with the help of the extra-European fellowships.

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18 The numbers here are: 57% of German mobile researchers went to the US, 27% to other West European Countries, 6% to Asia, 3% to Eastern Europe and 3% to Latin America, 2 % to Australia / New Zealand. As for originating regions, 32% of foreign reseaerchers in Germany came from Western Europe, 26% from Asia, 19% from Eastern Europe, 12 % from USA, 4% from Latin America, 3% from Australia/New Zealand (Grimpe et al 2007).

19 In addition, the 'excellence team' award has been open to non-European actors and 20% of scientists who have been awarded have come from outside the EU.

6 INTERNATIONAL COLLABORATION IN FP 6 AS AN ERA-DIMENSION

Coordinating between EU and Member States

Even before the launch of FP6 did the Commission issue a document on the international dimension of ERA. One objective, or one means, was to coordinate international collaboration with Member States (EU COM 2001). Seven years later, the latest communication of the Commission once again states this goal and gives, more specifically than in 2001, a list of concrete actions needed to make coordination for international S&T collaboration meaningful (EU COM 2008b).

If we assess the FP6 efforts to set up **more coordinated activities** in terms of international S&T collaboration, the **evidence for progress is rather weak**. The latest conference on drivers for international S&T collaboration (October 14-15, Brussels) discussed this issue with more than 150 policy makers and representatives from funding agencies and the academic community. There was a general sense of convergence, the need to better coordinate is obvious to most actors, even if a set of good examples were presented (e.g. ERA-Net see below). A set of important activities have been kicked off, most notably an expert group (EU Expert Group 2008), the CREST working group on internationalisation policies (CREST 2007, 2008), two workshops organised by the Commission on Coordination in International Collaboration and a study of the DG Research on drivers for international collaboration policies (Boekholt et al. 2008). However, these stock taking activities, while leading to sound recommendations as for how coordination would contribute to more efficiency and effectiveness, do not reveal much coordination at the moment.

Next to the evidence in the studies and the conference mentioned, we can also draw from the assessments of the bilateral STI agreements of the EU. Only one of the four assessments mentions coordination with Member States as an achievement of the STI agreements, while the others are critical. In the US (albeit rather at the beginning of FP6) there has even been some signs of irritation with partner country actors when confronted with a mix of Member State and EU level activities around parallel agreements (Kettunen et al. 2003). The assessment calls for better coordination to streamline activities, to generate synergies and to ease the coordination process for the partner countries. Thus, there seems to be a potential for more synergies especially for smaller Member States through better coordination and mutual information.

For China, the situation was assessed to be a bit different. Here we see a coordination of the EU with smaller Member States, whereby apparently those Member States could utilise the STA agreement and the activities it offered for further bilateral activities, so that the EU presence was catalytic for small Member State activities (Watson et al. 2004, 13).

Coordinating Member States: ERA-Net

FP 6 offered also new instruments for flexible policy **coordination between Member States** through ERA-Net and ERA-Net plus. The idea of ERA-net is to bring together programme owner and managers of a group of countries that share a common interest in a specific research area in order to explore possibilities of coordinating

their efforts, in some cases leading to jointly funded calls (ERA-Net plus). The instrument was originally not part of the internationalisation agenda of FP 6. However, a couple of ERA-Net developed into instruments to coordinate Member State activity vis-à-vis third countries / regions (in FP 7 this has been developed into so-called INCO-Net within the INCO programme, this time explicitly including as one of the objectives to support meaningful co-operation between the target region and European actors within FP7). In addition, a range of other ERA-Nets in FP 6 had considerable international activities. Some examples are given in the box below.

Exhibit 1: International Dimension of ERA-Net

ERA-NET (CA)						Joint calls / programmes		
Name	**Contract**	**Area**	**Start date**	**End date**	**Countries**	**Done**	**Lauched**	**Planned***
CO-REACH	16185	Europe and China	01/05/2005	30/04/2010	9	-	Not yet	-
ERA-ARD	517837	Agricultural Research for Development	01/04/2005	31/03/2009	14	-	Not yet	-
EULANEST	36271	Latin American Network	01/07/2006	30/06/2010	5	-	Not yet	-
SEE-ERA-NET	515805	Southeast Europe	01/09/2004	31/08/2009	14		1	

*) "Planned calls" are calls for which concrete planning has already started, which means that most of these calls are to be launched in 2007. Some ERA-NETs have foreseen further calls at a later stage, in some cases described in the Description of Work.

Some other ERA-NETs cooperate with third countries without it being their primary focus, for example:

- iMERA (metrology) included a number of third countries in a joint call (incl. USA and Japan)
- ECORD (deep sea ocean drilling) coordinates the participation of European countries in the International Ocean Drilling Program (IODP), set up by USA and Japan.
- BONUS (Baltic Sea Research) has a Russian partner
- EUROPOLAR (polar research) has a Russian partner
- ERA-SAGE (Societal aspects of Genomics) has a Canadian partner
- EraSysBio (Systems biology) has a Russian partner
- EU-SEC is coordinated by UNICRI

Source: Wittke 2008

In an internal EC survey conducted in 2006, 20 % of the responding ERA-Net indicated to have at least one international partner in the ERA-Nets and **almost 50%** of the ERA-Nets would **welcome a global dimension** of their net, especially if there would be a sound coordination across Europe as a preparatory step (Wittke 2008). The activities of the four ERA-Nets mentioned in the box above indicate that new forms of joint action with partner regions are being developed (see example Co-Reach below), joint action that links to the Framework Programme and is flexible in terms of participation, clustering Member States regionally (e.g. See-ERA-Net (West Balkan region).

CO-Reach – an ERA-Net in FP 6 as means to coordinate for international collaboration

CO-Reach brings together 16 European partners and almost the same number of Chinese counterparts (ministries and funding organisations and Academy of Science etc.), with the following mission:

'This network is intended to create coherence and synergy in Europe's S&T relations with China. It will do so by promoting the co-ordination of China related policies and associated research funding programmes of individual European countries, and integrating these efforts with those of other multi-lateral European initiatives, including the programmes and agreements of the European Commission."

The first pilot activities, two joint programmes in social science and sustainability, have been launched in 2008 and the network has come to provide a dynamic information system on scientific and funding activities, a whole range of high level joint events and a platform for multilateral and bilateral Chinese schemes (www.co-reach.org). The coordination gain is not only through new funding programmes, but through reducing complexity, through pooling expertise and networks CO-Reach established the ground for further multi-lateral and bi-lateral activity. While there is still a way to go for a clearer identity of the network, it has already changed the way the science and funding discourse between Europe and China is led, without distorting the flexibility of single country approaches or of smaller country groupings to develop their own strategies. The following matrix shows how the *Norwegian* Research Council organises their strategy towards international collaboration with China, using bi-lateral, multi-lateral and pooled (ERA-Net) approach (Kveseth 2008).

LEVEL \ THEME	*Energy, Environment, Polar Research*	*Hydrology, Water Management*	*Economy, Welfare, Regional Development*
EU FP-7 and other international frameworks	CO-REACH, OECD-Project, INNO-Net and others	CO-REACH, OECD-Project, INNO-Net and others	CO-REACH, OECD-Project and others
Nordic framework and initiatives	Nordic Centre Fudan, NORIA-Net and other Nordic Organisations	Nordic Centre Fudan, NORIA-Net and other Nordic Organisations	Nordic Centre Fudan, NORIA-Net and other Nordic Organisations
Norwegian MoUs, links, cooperation	MOST, NSFC, CAS, other MoUs, BILAT	MOST, NSFC, CAS, other MoUs, BILAT	MOST, NSFC, CASS, other MoUs, BILAT

Coordinating international collaboration with and for industry.
The role of Technology Platforms

Between 2002 and 2006 31 ETPs have been established. The TP have been new instruments to support a systematic discourse and the development of future strategic research agendas (SRA) for certain technologies or sectors. In FP7 five TPs have been transferred into Joint Technology Initiatives that now constitute a new for

of public private partnership between the Commission, the Member States and industry with a view to long term financing of research in the area.

The ETPs have had an **in-built international dimension**. First, many of the leading **companies are multi-national**, firms active on a global scale. Through integrating those companies into the ETPs the definition of European strategic research agenda has automatically been linked to global dynamics. Second, through developing systematic activities to define future research directions and technology options, ETPs have **taken into account the global developments** especially when it comes to the definition of future potential global lead markets. Third; some of the JTIs (Artemis, ENIAC) have their roots in EUREKA clusters that had partners from countries outside the EU (see also EU Expert Group 2008, p. 46). This is, by the way, an example how the EUREKA scheme, which is outside FP6, can be catalytic role for transnational, extra-European co-operations that is industry led. To analyse this role systematically would be important if one wants to understand the role of supporting schemes for extra-European collaboration more generally.

Fourth, the **ETP have started to develop international activities and integrate extra-EU partners**. The latest EU status quo report on ETP (EU COM 2007c) obliges the ETP to report on their international activities, mainly during FP6. On this basis, one can get some indication as to the strategic aspiration as for international collaboration. A systematic scan of those short reports shows that 21 out of the 31 ETPs have concrete international activities on an operational level or even strategic aspirations. For 10 ETP the international activities are either not mentioned at all (3 ETP) or only mentioned in passing, relying on being leading edge or seeing the international dimension as market to be secured.

Most of these 21 ETPs that have a more pro-active approach see themselves as **European focal point and hub** for international discourse and partnering in the future with strategic ambitions, others have strategically incorporated international organisations in their membership in order to link up with and influence global strategies (and regulations). Some have already entered a whole range of collaboration projects, many of which explicitly linked to FP6 INCO projects (and one EUREKA). Two examples of strategic approaches for international collaboration in ETP are given in the box below. The five Joint Technology Initiatives that have been established so far in FP7 will build on the preparation under the FP6 ETP scheme, and others will follow.

International dimension in FP 6 Technology Platforms – Two Examples

ARTEMIS – The international dimension of an ETP in FP 6 (prior to its launch into JTI)
(Source: EU COM 2007c, Annex p. 66)
The objective of the ARTEMIS international co-operation strategy is to define "modalities" for interaction between the European R&D community, and the main international players in the area, including research institutions, professional organisations (ACM, IEEE), standardisation bodies (e.g.: OMG, IEEE), large consortia, funding agencies (e.g.: IST, NSF, DARPA). International Collaboration covers a potentially wide range of activities, from the organisation of technical meetings, high-level meetings, conferences, schools, and joint international projects. These may have various aims, including education and training, dissemination, definition of standards, and development of joint R&D activities. It is clear that International Collaboration should fit into a global win-win strategy, for achieving the participants' long-range aims. Dedicated actions are carried out with regard to co-operation with Nanoelectronics platforms in the USA and the Far-East (see, e.g. *www.inc-conf.net*) ENIAC is actively involved in the INC Conferences, which target international collaboration / co-operation in the field of Nanoelectronics and Nanotechnology.

Hydrogen and Fuel lCell Platform – The international dimension of an ETP in FP 6
(Source: EU COM 2007c, Annex p. 5)
The International Partnership for the Hydrogen Economy and the IEA implementing agreements for hydrogen and fuel cells are the main fora for research co-operation beyond the EU. The former is established by ministerial charter signed by 17 members, including several EU members. It aims to further international co-operation on hydrogen and fuel cell technologies and support activities of common interest, such as safety, codes and standards, and analysis in support of policy-making. The work of the HFP platform has provided a European focus for these international co-operation activities and the European partners' contributions to the definition of common research priorities in the IPHE has drawn heavily on the work of the SRA, Deployment Strategy and the Implementation Plan. International co-operation is very important in specific areas, notably where there are challenging technical barriers, or issues of common interest (e.g. sustainability, safety, standards).

When assessing the international dimension of the FP6, we must acknowledge the **tidal change** these ETP mean, or might mean. European industry not only develops **common foresight** and planning activities, but **speaks with one voice** (at least in technology oriented global discourse), has a hub and focal point in various key technologies, thinks about strategic global partnering and links this partnering with considerations about markets and competitiveness. This is, again, not free from tensions, as some of the less active ETP clearly show. But, it helps **to improve the role of Europe in industry driven, future oriented global discourse**, **regulation and co-operation.** There is no room for naïve optimism, and the JTI building on the TP will have to be looked at very carefully. But, the opportunity structure created through this FP 6 instrument has to be assessed positively when it comes to the international dimension of FP 6.

7 SUMMARY AND CONCLUSIONS

1) Europe has a **unique position** to be global leader in international STI collaboration. Not only has Europe the most international co-publications of all regions / countries, it also has the most diverse range of partners. Despite shortcomings, the FP 6 has certainly contributed to secure this position, to open additional possibilities for collaboration and to step into a new world of coordination.

2) FP 6 has mobilised a number of extra European partners for joint international activities. **5,6%** of all funded partners were from outside Europe. For some third

partner countries, Russia, China, India, Brazil, the development of participation has been promising, but **does not account for the changing role of those countries**. Further, the FP6 has been important in linking New Member States to the World, or **keeping up links with neighbouring regions**, as the participation in INCO projects (by definition with INCO partners) is – by and large – higher with small and New Member States.[20]

3) In light of the overall magnitude of global cooperation in STI, the **2,6 % of the budget** that were finally spent for foreign partners **appear to be moderate**, especially when one realises the huge potential that lies in capacity building elsewhere, capacities that are then linked to and compatible with the European Innovation System.

4) FP6 has been **no means to tap into the excellence at least in industrialised world**. The collaboration with partners form leading centres in industrialised countries is weak, and new ways of joint funding and reciprocal opening of programmes – as tried in FP7 – are needed if the Framework Programme does not want to become too lopsided towards INCO countries.

5) With INCO FP 6 has made the attempt to **design regional strategies** that are driven by **defined problem** areas **linked to development and foreign policy.** This strategic approach is to be welcomed, but had its shortcomings: there is some lack of transparency as to the link to development and foreign policy and clear challenges for the inter-administrative coordination. Further, despite obvious positive effects on the project level, we do not know ther relative importance of INCO for the development policy and for the INCO countries more generally. The overall sum spent for third countries from around the globe in INCO appears to be rather low over the duration of the whole FP (133 million EURO). Equally, the call for additional international partners in running projects during the lifetime of FP 6 indicates some mobilisation issue.

6) At the same time, it appeared that **partners from emerging countries moved from INCO into the regular specific programme** 'Integrating and Strengthening the ERA'. Thus, the integration of INCO into the thematic areas in FP7 may be a logical consequence from some FP6 experience. However, there is now the danger that the development aspect and the capacity building aspect based on regional drivers with reference to problems in those regions is lost. A **balance** would be needed between **integrating into the regular theme framework** and being **flexible to the local context and specific needs**. This is a challenge for the committees that deal with the various countries or regions and for the way calls are drafted and decision taken, as the conflict between leading edge on the one hand and capacity building and catching up on the other hand is re-integrated into the cooperation programme.

7) The international dimension of FP 6 has been **less attractive for industry partners**, the industry orientation in general in the international dimension is not

[20] More analysis as to the country cooperation patterns is needed, however.

very pronounced. Further, an **opportunity seems to be lost** in a **weak inclusion of excellent third country partners into the Network of Excellence**, which could – in areas in which the nature of knowledge production would demand it – be transferred into global networks or platforms.

8) In terms of thematic focus, the international participation in FP6 has been **lopsided towards sustainable development**, both within INCO (see the table of projects) but also within the regular specific programme. The latter reflects not only the specific capabilities and interests of the third country partners, but a specific motivation pattern of European partners to collaborate with partners from INCO countries.

9) The design of the **international mobility schemes** in FP 7 – and that is why they have been introduced rather lengthy in the report – has **met the right demands** and tried to strike a balance between brain circulation on the one hand and the possibility to recruit from advanced countries. To fund the returning phase for a highly skilled researcher of a developing country is a sign of strength for Europe, trusting in the benefit of lasting partnership with developing countries rather than the quest for brain gain at the detriment of others. Ways in **securing broad integration of external fellows** into the local environment and a broad exchange with local and other international actors in Europe should be found, e.g. more funding of non-fellows to common training courses or conference events. The focus on reintegration also is timely, bringing the benefit of international experience back home.

10) However, the **mobility to the emerging countries** has not matched their relative importance in the future, and specific effort especially for outgoing fellows to those emerging scientific strongholds will be essential in the future.

11) The greatest achievement however is only a start, a start to a journey into a much **more complex and interlinked strategy**. FP 6 and ERA have laid the seed for **new forms of joint action**, including a new layer of public and private actors in organising (also) international activities, striving for a more functional approach to international collaboration. The INCO-Net in FP 7 are a result of the ERA-Net idea, the ETPs and JTIs might change the fabric of industry driven strategy making and funding in STI in Europe with strong implication for collaboration and competition.

12) However, on the **strategic policy level**, a new, **much more daring approach to coordination** is needed, here FP 6 was poor. There is much untapped potential, in bundling activities, in creating joint hubs, in exchanging intelligence, in complementing capacity building, in defining joint priority areas, in building up common networks, in coordinating capacity building. A **flexible architecture** is needed that combines European level action (FP and facilitation(!) of Member State coordination), INCO Net approaches (issue and geography driven variable geometry), small scale multi-lateral schemes and unilateral approaches. Some principles for a vertical division of labour could be defined and tested (see the Norwegian examples vs. China, section 6). This would define a sustainable

comparative advantage of European governance vis-à-vis any other competitor in the world.

13) Such a strategy would also have to **include sectoral policy approaches**, existing structures in domain based International Organisations (such as International Energy Agency) in order to link global STI with sectoral policy, whereby Europe can play a mediating and facilitating role. This has not been present in FP 6.

14) For effective policy learning, it would be indispensable for the future to have a **thorough analysis of the constraints and benefits of international collaboration** within FP for the (potential) participants and as regards the stated objectives of the FP, both in terms of structures and in terms of contribution to policy. There is no impact assessment available as for the contribution of framework programme funded project to those broader policy goals. We even lack the indicator system to understand effects, both on institutional level and as for research content directions, and real impact takes a long time to show. This is a problem in all national strategies that claim to link S&T co-operation with broader societal goals. This should not mean that we should not start to tackle it.

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